CDM Camp Dresser & McKee

Illinois Environmental Protection Agency

Southeast Rockford Source Control Operable Unit Focused Feasibility Study Volume I of III

September 5, 2000

Final

Project Number: 1681

Report

ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

(217) 524-6365

March 27, 2001

Mr. Russell Hart
Remedial Project Manager
U.S. Environmental Protection Agency
77 West Jackson Blvd., SR-6J
Chicago, Illinois 60604-3590

Re: L2010300074 Winnebago Co.
Southeast Rockford Groundwater Contamination
Amendments to Final Feasibility Study Report
Superfund/Technical Reports

Dear Mr. Hart:

Please find enclosed a copy of two memos detailing minor amendments to the Final Feasibility Study Report for the Southeast Rockford Groundwater Contamination Site, source control operable unit (OU3). As stated within the memos, please place these in your file so that anyone viewing the FS documents can note the changes. Thank you.

If you have any questions, please contact me.

Sincerely,

Gerald E. Willman

Gerald E. Willman
Remedial Project Manager
National Priorities List Unit
Division of Remediation Management
Bureau of Land

Attachment

cc: Bureau File (w/o attach.)

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ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276

THOMAS V. SKINNER, DIRECTOR

MEMORANDUM

DATE: February 20, 2001

TO: Bureau File (for insert into September 5, 2000 Feasibility Study, Volume 1)

FROM: Jerry Willman JW

SUBJECT: Minor changes to original document

SITE NUMBER: 2010300074 Winnebago
Southeast Rockford Groundwater Contamination
Superfund/Technical

This memorandum is intended to amend **Volume I** of the Source Control Operable Unit (OU3) Feasibility Study Report dated September 5, 2000, and shall be inserted beneath the front cover of the report within the Bureau file and site repositories.

Following the completion of the Feasibility Study, several minor errors have been identified (i.e. typographical errors, etc.) within the report. In addition, several alternatives described within the report have been slightly modified affecting the final cost for that alternative.

In cases where a simple change in text adequately addresses the error, the original text is included within this memorandum, followed by its correction in **bold** text. In cases where more complex changes are required the entire page (or table) has been revised and is included as an attachment to this memorandum.

Changes to Volume 1

Added Text	Page 7-15;Following first complete paragraph	**"It is anticipated that contaminated soils are located beneath the existing building structure on the property. During excavation of contaminated soils, a portion of the building may have to be demolished and shipped off site for disposal. Following completion of the excavation and treatment of contaminated materials, any portions of the building that were demolished could be replaced."**

Incorrect Statement	Page 7-15; Second paragraph	"The production rate of this system ranges from 80 to 120 tons per hour depending on soil type and moisture content."
Correction	**"The system treats soil at a rate of approximately 15 tons per hour depending on soil type and moisture content."**	

Incorrect Information	Page 7-18; First Paragraph	"The total capital costs associated with this alternative are estimated at $1,719,000."
Correction	**"The total capital costs associated with this alternative are estimated at $2,121,000."**	

Insert	Page 7-19;Table 7-4: Table 7-4 has been amended and is attached to this memorandum.

Added Text	Page 7-20; Section 7.3.2; First Paragraph	"Physical access restrictions would consist of construction and maintenance of perimeter security fencing and warning sign replacement. **The fencing would be installed to discourage any excavation in the area that could result in contact with contaminants."**

Incorrect Information	Page 7-32; Second Paragraph	"A total of 57 air sparge wells would be constructed to a depth of 50 feet below ground surface."
Correction	**"A total of 53 air sparge wells would be constructed to a depth of 50 feet below ground surface."**	

Incorrect Information	Page 7-56; Section 7.6.2; First Paragraph	"The groundwater would be extracted through a series of six extraction wells, treated using air stripping and discharged on site to neighboring surface waters."
Correction	**"The groundwater would be extracted through a series of four extraction wells, treated using air stripping and discharged on site to neighboring surface waters."**	

Incorrect Information	Page 7-60; Last Paragraph	"Annual operation and maintenance costs are $16,000, and replacement costs are $107,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-4B would be approximately $732,000."
Correction	**"Annual operation and maintenance costs are $47,000, and replacement costs are $107,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-4B would be approximately $1,117,000."**	

Insert	Page 7-61;Table 7-17:Table 7-17 has been amended and is attached to this memorandum.

Incorrect Information	Page 7-95; First Paragraph	"The groundwater would be extracted through a series of fifty extraction wells, treated using air stripping and discharged off site into neighboring surface waters."
Correction	**"The groundwater would be extracted through a series of fifty-five extraction wells, treated using air stripping and discharged off site into neighboring surface waters."**	

Insert	Page 7-112, Figure 7-21. A new figure, 7-21, has been added showing the locations of proposed monitoring wells for Alternative SCL-11A. The new figure is attached to this memorandum

Insert	Page 8-2;Table 8-1:Table 8-1 has been amended and is attached to this memorandum.

Insert	Page 8-12;Table 8-5:Table 8-5 has been amended and is attached to this memorandum.

TABLE 7-17

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
FOCUSED FEASIBILITY STUDY
ROCKFORD, ILLINOIS

AREA 4 - LEACHATE
ALTERNATIVE SCL-4B: LIMITED ACTION / LEACHATE MONITORING / LEACHATE COLLECTION AND TREATMENT BY AIR STRIPPING UNIT / OFF-SITE SURFACE WATER DISCHARGE / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Containment System	$118,000
Leachate Monitoring Wells	$18,000
SUBTOTAL CONSTRUCTION COSTS (1)	$161,000
Bid Contingency (15%)	$24,000
Scope Contingency (20%)	$32,000
Engineering and Design (15%)	$24,000
Oversight/Health and Safety (5%)	$8,000
TOTAL CAPITAL COSTS	$249,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Containment System	$7,000
Granular Activated Carbon	$31,000
Leachate Containment System Sampling and Analysis (per event)	$4,000
Leachate Sampling and Analysis (per event)	$5,000
TOTAL ANNUAL COSTS	$47,000
REPLACEMENT COSTS (2)	
Leachate Containment System (every 15 years)	$78,000
Monitoring Well Replacement (every 15 years)	$29,000
TOTAL REPLACEMENT COSTS	$107,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$249,000
Present Worth Annual O&M Costs (4)	$472,000
Leachate Containment System	
Quarterly Sampling - years 1 through 30	$200,000
Leachate Monitoring Wells	
Quarterly Sampling - years 1 and 2	$37,000
Semi-annual Sampling - years 3 through 30	$106,000
Present Worth Replacement Costs (5)	$53,000
TOTAL PRESENT WORTH	$1,117,000

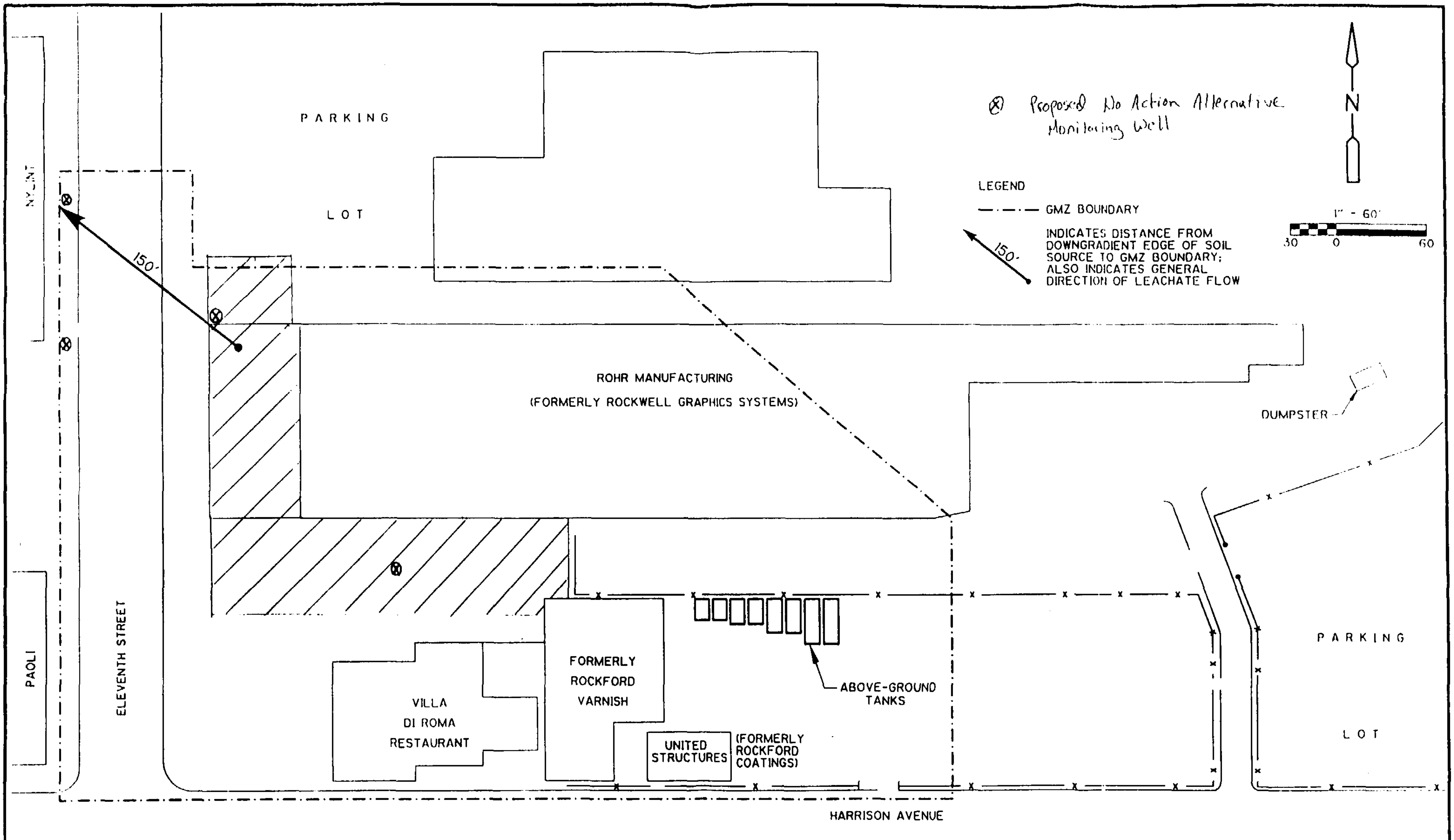
(1) Capital costs for construction items do not include oversight fees.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells replacement and leachate collection system (including extraction wells, piping, pumps, and air stripping unit) every 15 years.

TABLE 7-4
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 4
ATIVE SCS-4D REVISED 1: PARTIAL DEMOLITION, EXCAVATION, AND ON-SITE THERMAL TREATMENT
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	General	$52,000
	Demolition/ Construction	$99,000
	Excavation / On-Site Thermal Treatment	$719,000
	Excavation Dewatering	$532,000
	Post Treatment Sampling	$12,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$1,414,000**
	Bid Contingency (15%)	$212,000
	Scope Contingency (15%)	$212,000
	Engineering and Design (15%)	$212,000
	Oversight/Health and Safety (5%)	$71,000
	TOTAL CAPITAL COSTS	**$2,121,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	General Maintenance of Thermal Treatment System	$0
	TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS		
	TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$2,121,000
	Present Worth Annual O&M Costs (4)	$0
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$2,121,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% annual discount rate over a project life of 3 months.



CDM
environmental engineers, scientists, planners, & management consultants

Figure No. 7-21
Southeast Rockford Source Control Operable Unit
Rockford, Illinois
FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 11
SOURCE CONTROL ALTERNATIVE SCL-11A

TABLE 8-1
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL ALTERNATIVES FOR SOURCE AREA 4

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCS-4A: No Action	**No** Not protective of human health or the environment, except through natural attenuation.	**No** ARARs not attained.	**Low** No level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** No remedial actions take place under this alternative.	**$0**
SCS-4B: Limited Action /Deed Restrictions	**No** Somewhat protective of human health. Not protective of the environment. Requires maintenance to be effective.	**No** ARARs not attained.	**Low** Minimal level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** Administratively easy to implement if property owners comply.	**$28,000**
SCS-4C: Soil Vapor Extraction/Catalytic Oxidation	**Yes** Protective of human health and the environment. Reduces the mass of contaminants.	**Yes** Complies with soil ARARs within a reasonable time frame.	**Medium** Does mitigate further contaminant releases to groundwater. SVE is a well-demonstrated technology for the removal of VOCs.	**Medium** Significant reduction of toxicity, mobility and volume could be realized, however, residual NAPL could provide a continuing source of contaminants.	**Medium/High** Minimal risks to on-site workers and the surrounding community. The time frame for protection of human health and the environment is reasonable.	**Medium/High** Technically easy to implement.	**$2,156,000**
SCS-4D: Excavation and On-Site Thermal Treatment	**Yes** Eliminates risks associated with source material in less than 1 year.	**Yes** Complies with soil ARARs.	**High** Permanent Solution. Does not require long-term maintenance. Contaminants are thermally desorbed from soils.	**Medium/High** Eliminates mobility, toxicity, or volume of VOCs. Contamination underneath building could be problematic. Meets the regulatory preference to utilize treatment-based remedies.	**Medium** VOCs released during excavation and treatment can be effectively controlled. Eliminates risks associated with source material in less than 1 year.	**Medium** Technically easy to implement. There are space considerations and administrative delays associated with implementation.	**$2,121,000**

TABLE 8-5
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL LEACHATE ALTERNATIVES FOR SOURCE AREA 4

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCL-4A: No Action/Leachate Monitoring/Groundwater Use Restrictions/Natural Attenuation	**No** Protective of human health but not the environment	**No** ARARs not attained	**Low** No level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** Easily Implementable	**$269,000**
SCL-4B: Limited Action with Pump and Treat/Leachate Monitoring/Groundwater Use Restrictions	**Yes** Not fully protective of human health and the environment. Reduces the mass of contaminants.	**Yes** Complies with ARARs in a reasonable time frame.	**Medium** Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Residual NAPL could provide a continuing source of contaminants.	**Medium** Limits the mobility of the leachate-borne contaminants. A modest reduction in toxicity and volume could be realized.	**Low/Medium** Limited exposure during construction. The timeframe for protection of human health and the environment is somewhat long.	**High** Technically easy to implement	**$1,117,000**
SCL-4C: Air Sparging at GMZ Boundary/Leachate Monitoring/Groundwater Use Restrictions	**Yes** Not fully protective of human health and the environment downgradient of the GMZ. Reduces the mass of contaminants.	**Yes** Complies with ARARs in a reasonable time frame.	**Medium** Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Residual NAPL could provide a continuing source of contaminants. Reliable over long term. Effectively reduces contaminant concentrations in the areas where it operates.	**Medium/High** Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume	**Medium/High** Limited exposure during construction.	**Medium** Relatively straightforward to implement	**$2,522,000**
SCL-4D: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions	**Yes** Protective of human health and the environment downgradient of the GMZ. Reduces the mass of contaminants.	**Yes** Complies with ARARs.	**Medium** Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Effectively reduces contaminant concentrations in the areas where it operates.	**High** Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume	**Medium** Limited exposure during construction but physical dangers near homes. The shortest time period to achieve protection of human health and the environment	**Low to Medium** Relatively difficult to implement Excavation of trench and dewatering complicate construction	**$5,911,000**
SCL-4E: Air Sparging at Source and GMZ Boundary/Leachate Monitoring/Groundwater Use Restrictions	**Yes** Not fully protective of human health and the environment. Reduces the mass of contaminants	**Yes** Complies with ARARs in a reasonable time frame	**Medium/High** Complete long-term effectiveness in meeting RAOs Reliable over long term Effectively reduces contaminant concentrations in the areas where it operates.	**Medium/High** Effectively limits the mobility of the leachate-borne contaminants Effectively reduces contaminant toxicity and volume	**Medium/High** Limited exposure during construction Short time period to achieve protection of human health and the environment.	**Medium** Relatively straightforward to implement	**$2,796,000**

CDM Camp Dresser & McKee Inc.

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Tel: 312 346-5000 Fax: 312 346-5228

September 5, 2000

Mr. Gerald E. Willman
Bureau of Land, Mail Code #24
Illinois Environmental Protection Agency
1021 North Grand Avenue East
P.O. Box 19276
Springfield, IL 62794-9276

Subject: **Final Focused Feasibility Study Report**
Southeast Rockford Source Control Operable Unit
LPC #2010300074 – Winnebago County

Dear Jerry:

Camp Dresser & McKee Inc. is pleased to submit six bound copies of the *Final Focused Feasibility Study Report* to the Illinois Environmental Protection Agency. This report incorporates Illinois EPA's written and verbal comments received to date. This submittal has three volumes: Volume 1 consists of text, and Volumes 2 and 3 contain appendices. We appreciate the opportunity to submit this report and we look forward to supporting the Agency through the Record of Decision.

Very truly yours,

CAMP DRESSER & McKEE INC.

Snehal Bhagat

Snehal Bhagat, P.G.
Project Manager

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cc: Ronald D. French
File

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Appendix

List of Abbreviations

Abbreviation	
1,1,1-TCA	1,1,1-Trichlorethane
1,2-DCA	1,2-Dichloroethane
ARAR	Applicable or Relevant and Appropriate Requirement
bgs	Below Ground Surface
BRA	Baseline Risk Assessment
BETX	Benzene, Ethylbenzene, Toluene, and Xylene
CAA	Clean Air Act
CDM	Camp Dresser & McKee
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFR	Code of Federal Regulations
cm/s	Centimeters per second
COPC	Contaminant of Potential Concern
CWA	Clean Water Act
DCA	Dichloroethane
DCE	Dichloroethene
DNAPL	Dense Non-Aqueous Phase Liquid
ERSV	Exposure Route Specific Values
ETX	Ethylbenzene, Toluene, and Xylene
FFS	Focused Feasibility Study
FOC	Fraction of Organic Carbon
GMZ	Groundwater Management Zone
gpm	Gallons per Minute
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
HSWA	Hazardous and Solid Waste Act Amendments of 1984
HWIR	Hazardous Waste Identification Rule
IDPH	Illinois Department of Public Health
IEPA	Illinois Environmental Protection Agency
IGWPA	Illinois Groundwater Protection Act
IRIS	Integrated Risk Information System
IDW	Investigation Derived Wastes
ISWS	Illinois State Water Survey
LDRs	Landfill Disposal Restrictions
LNAPL	Light Non-Aqueous Phase Liquid
kg	Kilogram
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
ug/kg	Micrograms per kilogram
ug/L	Micrograms per liter

mg	Milligram
MGD	Million Gallons per Day
mg/kg	milligram per kilogram
MSL	Mean Sea Level
MTRs	Minimum Technology Requirements
NAAQS	National Ambient Air Quality Standards
NAMS	National Air Monitoring Station
NAPL	Non-Aqueous Phase Liquid
NCLP	National Contract Laboratory Program
NCP	National Oil and Hazardous Substance Pollution Contingency Plan
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPL	National Priorities List
PAH	Polycyclic Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyls
PCE	Tetrachloroethene
POTW	Publicly Owned Treatment Works
ppb	parts per billion
ppm	parts per million
PQL	Practical Quantitation Limit
PRA	Preliminary Risk Analysis
RA	Risk Assessment
RAL	Removal Action Level
RfD	Reference Dose
RBC	Risk Based Concentration
RBCA	Risk Based Corrective Action Model
RCRA	Resource Conservation and Recovery Act
RI/FFS	Remedial Investigation/Focused Feasibility Study
ROD	Record of Decision
SARA	Superfund Amendments and Reauthorization Act
SCGV	Soil Component of Groundwater Ingestion Exposure Route Values
SCOU	Source Control Operable Unit
SCL	Source Control Leachate
SCS	Source Control Soil
SDWA	Safe Drinking Water Act
SMCL	Secondary Maximum Contaminant Level
SPLP	Synthetic Precipitation Leachate Procedure
SSL	Soil Screening Level
SVOC	Semi-Volatile Organic Compounds
TACO	Tiered Approach to Corrective Action Objectives
TBC	To Be Considered
TCA	Trichloroethane
TCE	Trichloroethylene
TCL	Target Compound List
TCLP	Toxicity Characteristic Leaching Procedure

TOC	Total Organic Carbon
TSCA	Toxic Substance Control Act
UCL	Upper Confidence Limit
U.S. EPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VOC	Volatile Organic Compound

Section 1 Introduction

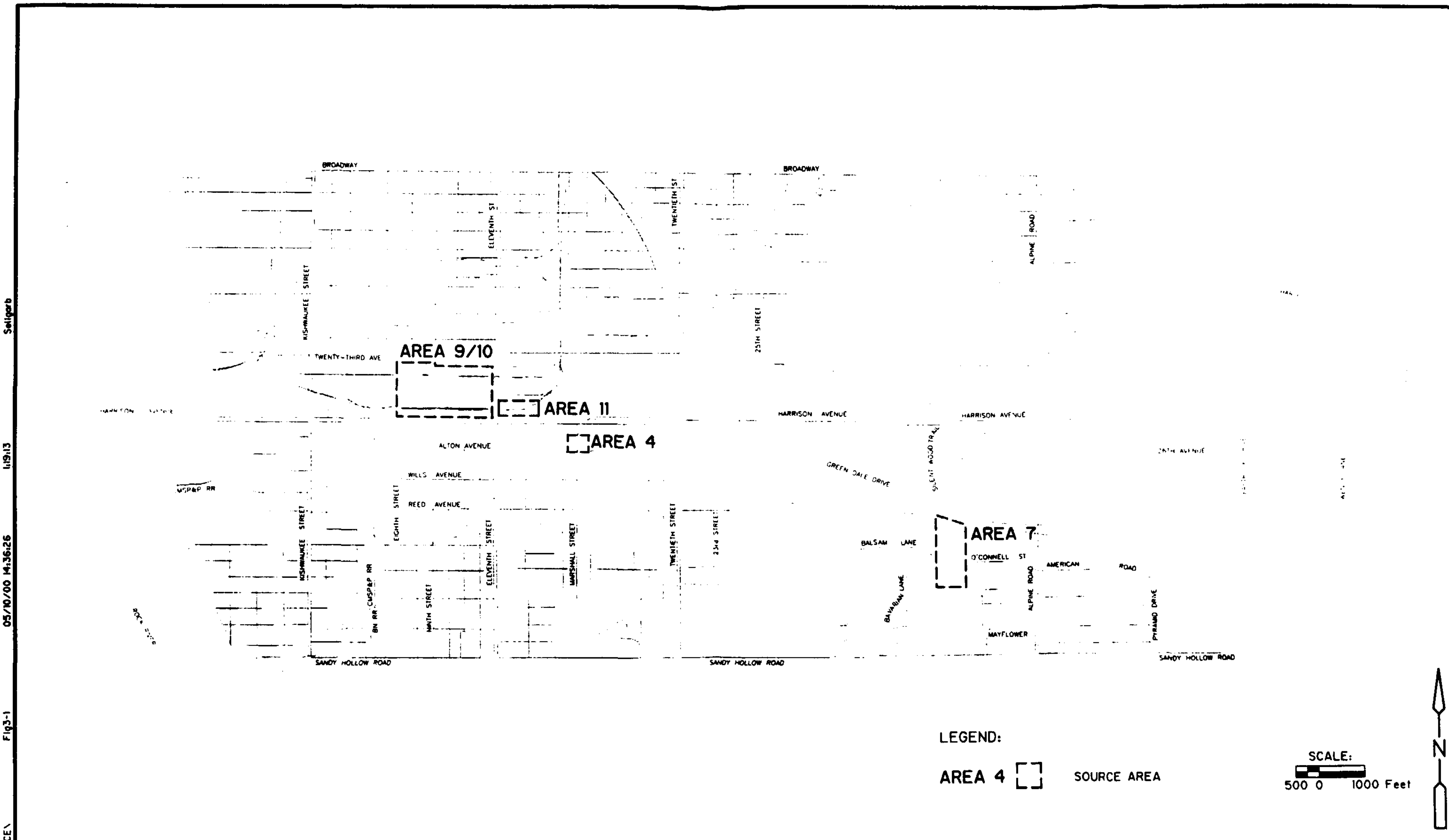
1.1 Purpose of Report

Camp Dresser & McKee Inc. (CDM) has been retained by the Illinois Environmental Protection Agency (Illinois EPA) to assist in the performance of a Remedial Investigation and Focused Feasibility Study (RI/FFS) at the Southeast Rockford Groundwater Contamination Site. This document presents the results of the FFS for the Source Control Operable Unit (SCOU) which is the third operable unit addressing contamination at this site. The SCOU focused on four source areas as identified on **Figure 1-1**.

The purpose of the RI/FFS is to evaluate the nature and extent of contamination at the Southeast Rockford SCOU, assess the human health and environmental risks posed by the site, and to identify and evaluate appropriate remedial actions that will primarily address contaminated source materials (soil and leachate) at the site. This RI/FFS will address source control measures only. Site-wide groundwater was addressed in the September 29, 1995 Record of Decision (ROD) that called for future source control measures to be determined later.

The FFS identifies, evaluates and screens available remedial technologies as the initial process in the development of remedial alternatives. Based on the technologies considered applicable, remedial alternatives are then assembled and subjected to an initial screening to identify those requiring more detailed evaluation. FFS activities are intended to be performed in a concurrent and iterative manner with RI and risk assessment activities. This FFS is intended to quickly narrow down the universe of alternatives to a reasonable number of relevant alternatives by using the presumptive remedy approach outlined in current U.S. EPA guidance.

This FFS is consistent with the Comprehensive Environmental Response Compensation & Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA) and to the extent practical, the National Contingency Plan (NCP), 40 CFR Part 300. This FFS has also been prepared in accordance with the documents titled, "Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA" (U.S. EPA 1988), "Presumptive Remedies: Policies and Procedures" (U.S. EPA, 1993) and "Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soils" (U.S. EPA, 1993).



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CDM
environmental engineers, scientists, planners, & management consultants

FIGURE No. 1-1
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOURCE AREA LOCATIONS

1.2 Background

Since 1980, the U.S. EPA's remedial and removal programs have found that certain categories of sites have similar characteristics, such as types of contaminants present, types of disposal practices, or how environmental media are affected. Based on information acquired from evaluating and cleaning up these sites, Superfund has undertaken an initiative to develop presumptive remedies to accelerate future cleanups at these sites. The objective of the presumptive remedies initiative is to use the past experience to streamline site investigations by focusing feasibility study efforts and therefore speed up selection of certain categories of cleanup actions.

It is noted that presumptive remedies for CERCLA sites with Volatile Organic Compounds (VOC) (*Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites With Volatile Organic Compounds in Soil, OSWER Directive 9355.0-48FS, September 1993*) consider only the vadose zone. Because the source areas at this site contain very high levels of VOCs and non-aqueous phase liquids (NAPLs) in the saturated zone, this FFS will also consider the saturated zone as a source material of VOCs. As such, this FFS will derive remedies for source materials and leachate that exists within the saturated zone, but will not address groundwater contamination present outside of Groundwater Management Zones (see 35 IAC 620.250). These zones will be defined for each source area later in this document. Groundwater outside of these zones will be referred to as "site-wide groundwater" throughout the report. For the purposes of this FFS, leachate will be defined as contamination originating from each source area that has migrated or could potentially migrate to the unconsolidated aquifer generally defined to be within the area of each Groundwater Management Zone. Additionally, this FFS will address compounds other than VOCs that are determined to be of concern based on the risk assessment. The presumptive remedy guidance for VOCs in soil will not apply to these compounds.

Based on different approaches to be used to develop and screen remedial alternatives for soil and leachate, alternatives for each medium have been presented separately.

1.3 Source Areas Description

The Southeast Rockford study area is located in Rockford, Illinois in Winnebago County, covering an area of approximately 10 square miles. The study area was bounded by Broadway to the north, Sandy Hollow Road to the south, Mulford Road to the east, and the Rock River to the west (Figure 1-1). The study area is predominantly suburban residential with scattered agricultural, industrial, retail and commercial operations. The study area boundaries were used only to specify the general area of study before the source areas and the extent of groundwater contamination were defined. After the source areas and extent of groundwater contamination were identified, study area boundaries were no longer necessary.

Area 4

Source Area 4 is situated in a mixed industrial/commercial and residential area located east of Marshall Street and south of Harrison Avenue. Area 4 is comprised of the former machine shop (Swebco Manufacturing, Inc.) located at 2630 Marshall Street. A residential trailer park (Barretts) is located northeast of Area 4.

According to previous site investigation results, elevated concentrations of trichloroethane (TCA) were detected in soil at a depth of 8 feet below ground surface (bgs) located in the former machine shop loading dock and parking lot areas. Also, elevated concentrations of chlorinated VOCs were detected in several downgradient groundwater monitoring wells. These groundwater results indicate that Area 4 is impacting the site-wide groundwater. No elevated concentrations of chlorinated VOCs were detected in the trailer park area.

Area 7

Source Area 7 is primarily an open grassy area located at the east terminus of Balsam Lane. Area 7 encompasses a city park (Ekberg Park) and an open area containing wooded areas. Ekberg Park consists of a basketball court, tennis court, and a playground. The open field and wooded areas exist south of the park on a hillside which slopes to the north. Two small valleys merge at the base of the hill, allowing surface water to drain northward into an unnamed creek. Private residences border the site to the west and southwest, and more distantly, to the east.

Part of Area 7 was once a gravel pit as shown on the Rockford South Quadrangle map (USGS 1976) and examination of aerial photographs since the 1950s indicates that various activities have occurred at this location. In particular, the 1970 aerial photo shows areas of excavation and disturbed ground in two large areas centered at about 600 and 1,300 feet east of the east end of Balsam Lane. A third suspect area is located along the small tributary valleys passing from southeast to northeast of Balsam Lane. In these valleys, debris and unvegetated spots are visible on the 1958, 1964, and 1970 aerial photos. In addition, the Illinois EPA as well as the U.S. EPA have received several reports of illegal dumping in the past in Area 7.

Based on previous site investigation results, elevated concentrations of ethylbenzene, toluene, xylene (ETX) and chlorinated VOCs were detected in soil in the northern portion of Area 7. The vertical extent of soil contamination extends to a depth of 27 to 29 feet. Chlorinated VOCs were also detected in shallow groundwater and surface water in the unnamed creek. The groundwater results indicate that Source Area 7 is impacting the site-wide groundwater.

Area 11

Area 11 is located north of Harrison Avenue and east of 11th street. Historically, manufacturing in Area 11 has included the production of paint and various varnish products for the furniture industry and gears and rollers for newspaper presses. Presently, a restaurant, machinery painting facility, and wood products supplier are active businesses in Area 11.

The Area 11 groundwater contaminant plume consists primarily of aromatics (xylene, toluene and ethylbenzene), though elevated concentrations up to 2,900 parts per billion (ppb) of several chlorinated VOCs are also present. Results from the Phase II RI field investigation (CDM 1995) indicate the presence of a non-aqueous phase liquid (NAPL) within Area 11. An NAPL is a liquid usually comprised of hydrocarbons such as fuels or solvents which do not mix with groundwater within the aquifer. The NAPL, within Area 11, is a light NAPL as indicated by its presence near the top of the water table. The thickness of the NAPL in Area 11 is generally 5 to 10 feet and locally as great as 25 feet.

Area 9/10

Area 9/10 is an industrial area that is bounded by 11th Street on the east, 23rd Avenue on the north, Harrison Avenue on the south, and 6th Street on the west. This part of the study area has a long history of industrial activity that extends as far back as 1926 when the Rockford Milling Machine and Rockford Tool companies merged to become the Sundstrand Machine Tool Company, located at the northwest corner of 11th Street and Harrison Avenue (Lundin 1989). Industries in the area include Sundstrand Corporation's Plant #1 (2421 11th Street), which extends from 11th Street westward to 9th Street, the former Mid-States Industrial facility, Nylint Corporation warehouse (formerly occupied by General Electric), Paoli Manufacturing, Rockford Products Corporation, Rohrbacher Manufacturing, and J. L. Clark.

According to previous investigations, an outdoor drum storage area associated with the former Sundstrand Plant #2 was located at the southwest corner of the Sundstrand parking lot (9th Street and 23rd Avenue). From 1962 to 1985, various 55-gallon drums of VOC-bearing materials including of tetrachloroethene (PCE), TCA, toluene, acetone, and methylene chloride were stored in this area. In addition, the dock area at Sundstrand Plant #1 from 1962 through 1987, housed approximately 14 underground storage tanks (USTs). These USTs were constructed of steel and contained solvents, cutting oils, fuel oil, and jet fuel (JP4). The solvents included PCE, TCA, and used TCA.

1.4 Site History

The Southeast Rockford Groundwater Contamination Site was added to the National Priorities List (NPL) in March of 1989 as a State-lead, federally-funded NPL site.

Earlier groundwater investigations by the State indicated that many private and municipal wells were impacted by chlorinated solvent contamination at levels exceeding federal health standards. These investigations formed the basis of the NPL listing. By late 1990, 293 residents were hooked up to the City of Rockford's municipal water supply system by U.S. EPA in an emergency action. Residents in the area were eligible for hook-ups using U.S. EPA emergency funds because several residential wells had contaminant levels above removal action levels (RALs). The areal extent of the hook-ups was determined by U.S. EPA with support from Illinois EPA.

The next course of action was to address residential wells whose contaminant levels were below RALs, but above federal health standards (Maximum Contaminant Levels or MCLs). CDM, under the direction of Illinois EPA conducted a residential well sampling investigation that was to become the first of three Operable Units to address site-related contamination. Pursuant to this study and its recommendations, a Record of Design (ROD) was signed in June of 1991. This ROD called for an additional 264 homes to be connected to the City's municipal water supply and the construction of a granular activated carbon (GAC) treatment system on one municipal well. The GAC unit was installed as a temporary measure that would be finalized in the second Operable Unit.

Between 1991 and 1994, an inclusive two-phased remedial investigation (RI) was performed to define the nature/extent of groundwater contamination and to gather preliminary information on the source areas responsible for residential well contamination. These actions culminated in a second ROD signed in September of 1995 that essentially called for additional hookups to the City's water supply, groundwater monitoring, continued operation of the GAC unit installed in the first ROD and future source control measures at four "major" source areas of site-related groundwater contamination. Pursuant to a consent decree with the City signed in early 1998, the City has agreed to implement all provisions of the second Operable Unit ROD.

As referenced in the RI noted above and the SCOU RI recently completed, the four major source areas to be addressed in this FFS will be Area 4, Area 7, Area 9/10 and Area 11.

1.5 Organization of the Report

The organization of the SCOU FFS Report is as follows:

Section 2 provides background information for the FFS. Included in this section is a brief summary of the RI and Risk Assessment for the SCOU.

Section 3 of this document presents the remedial action objectives. Remedial action objectives are site specific statements, which define the degree of cleanup necessary to protect human health and the environment. The Applicable or Relevant and Appropriate Requirements (ARARs) for possible remediation activities are also presented in Section 3. When establishing the degree of cleanup necessary to be protective of human health and the environment, CERCLA requires the consideration of ARARs. ARARs evaluated within this FFS as prescribed within the CERCLA *Compliance with Other Laws Manual* (EPA 1988). Section 3 also summarizes the results of the Risk Assessment for the site, which along with ARARs, is used to determine remediation goals. Remediation goals are numeric concentrations which the remedy must achieve in order to be protective of human health and the environment.

Section 4 of this document presents the identification, screening, and evaluation of technologies and process options for the remediation of the SCOU. Technology selection and screening, information on soil/leachate technologies chosen and/or implemented at other CERCLA and RCRA sites with similar contaminants and media were compiled from existing EPA guidance and overview documents and treatability technology databases. Specifically, those technologies listed in U.S. EPA Guidance as presumptive remedies for VOCs in soils were included in the preliminary list of potentially applicable soil technologies. This list of technologies will be expanded based on the results of the RI which indicate that the saturated zone is affected to a degree that would affect the groundwater source area.

Section 5 of this document provides the documentation for the development and initial screening of the remedial action alternatives for leachate only. No initial screening for soil alternatives is necessary because the presumptive remedy approach is utilized for the soil. The presumptive remedy approach uses a small group of preferred technologies, which have been historically used for common categories of sites rather than screening a more comprehensive group of technologies, which often do not apply. The presumptive remedy approach streamlines the FFS process.

Section 6 presents the fate and transport analysis. Fate and transport analysis includes all media (soil and leachate) and contaminants (VOCs) posing an unacceptable level of risk.

Section 6 presents the fate and transport analysis. Fate and transport analysis includes all media (soil and leachate) and contaminants (VOCs) posing an unacceptable level of risk.

Section 7 provides a detailed analysis of the soil and leachate remedial alternatives. This analysis entails an evaluation of the overall protectiveness, compliance with ARARs, long-term effectiveness, contaminant reduction, implementability, short-term effectiveness, and cost. Section 8 presents the comparative analysis of the alternatives. Section 9 lists references used to prepare this report.

Section 2 Background

The purpose of this section is to briefly summarize the results of the RI and previous site investigations and Risk Assessment activities conducted for the SCOU. This information will serve as the basis for understanding the existing site conditions, the fate and transport analysis and the FFS alternative development and evaluation.

2.1 Summary of Remedial Investigation

The Source Control Operable Unit (SCOU) RI (CDM 1997) makes use of data collected during the field activities for the SCOU and data collected during the second operable unit Remedial Investigation to describe the source area characteristics, nature and extent of contamination, and fate and transport mechanisms. The main findings of the investigation are summarized below.

2.1.1 Area 4

Subsurface investigation on the south, east and north side of the former Swebco Manufacturing property indicate that the source of soil VOC contamination in Area 4 is limited to the area beneath the parking lot. Elevated concentrations of soil vapor have migrated eastward from the source area and beneath the western portion of Barrett's Trailer Park, but soil contamination was not found in the park. An 8-foot thick residual NAPL zone is present at the water table in the source area, but dense non-aqueous phase liquid (DNAPL) was not observed to a depth of 62 feet below ground surface (bgs), where the top of a low permeability clay unit was encountered. The NAPL is not present as a floating layer, but is within the soil pore spaces. The estimated volume of contaminated soil in Area 4 is 30,000 ft^3 and the maximum observed soil concentration was 510,000 parts per billion (ug/kg) of TCA (**Figure 2-1**), the primary VOC contamination in Area 4. Downgradient wells contained high concentrations of TCA indicating migration through groundwater.

The Area 4 plume contains relatively minor amounts of benzene, toluene, ethylbenzene, and xylene (BETX) compounds relative to alkanes. A resultant oxygen-rich environment could be presumed to be present in the vicinity of the Area 4 plume. This oxidizing environment would in turn hinder the degradation of the chlorinated VOCs such as trichloroethylene (TCE) and TCA accounting for the relatively low concentrations of associated daughter compounds such as dicloroethene (DCE) and dichloroethane (DCA) detected in the soil and groundwater.

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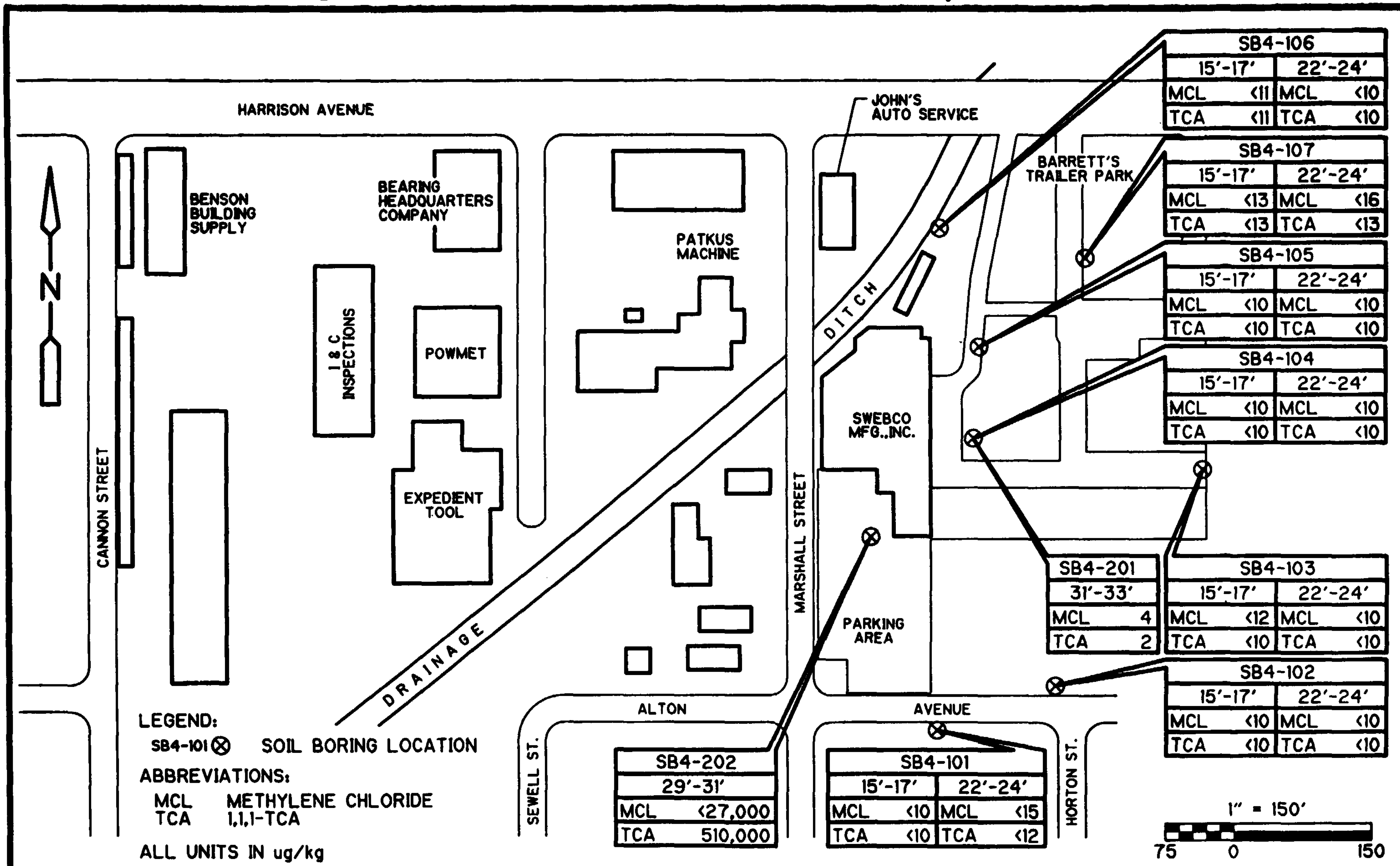

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FIGURE No. 2-1
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY
AREA 4 SUBSURFACE SOIL
DATA FOR VOCs

2.1.2 Area 7

The extent of VOC soil contamination investigated at Area 7 extends northward from the north end of Ekberg Park for a distance of approximately 150 feet. **Figures 2-2** and **2-3** show the extent of soil contamination for total VOCs and xylene respectively. The vertical extent of contamination extends to a depth of at least 27 to 29 feet in the northern part of the park, based on the maximum depth of drilling as shown in **Figure 2-4**. Residual NAPL was found at a depth of about 27 feet in one boring, corresponding to 11 feet below the water table. The estimated volume of VOC-contaminated soils is 265,000 yd^3 in Area 7 (including the volume estimated during Phase II), and the maximum observed soil concentration was 875,450 ug/kg of total VOCs. Surface water in the creek along the north boundary of Area 7 contains low levels of the same VOCs found in Area 7 soils, indicating that shallow groundwater from Area 7 is locally discharging to the creek. Creek sediments did not show impacts from VOCs.

The residual NAPL zone in Area 7 is complex in composition as it contains high levels of chlorinated VOCs as well as high levels of aromatics. As in Area 4, this NAPL is not a free floating layer but it is within the soil pore spaces. The relatively high proportion of aromatic compounds in Area 7 may account for the high proportion of biodegradation products in subsurface soils and down gradient groundwater. Area 7 also contains contaminated silt and clay units suggesting that NAPL has migrated into the fine-grained sediments.

2.1.3 Area 9/10

Significant sources of chlorinated VOC contamination are likely present at Sundstrand Plant #1, based on soil gas and groundwater data that show little or no contamination on the upgradient side of the plant and elevated concentrations on the down gradient side. Moreover, known releases of chlorinated VOCs have occurred on the Sundstrand property (e.g. at the former Plant #2 location). Additional soil sources may be present at the Mid-States Industrial facility and the property where the Nylint warehouse is located. Based on the results of previous investigations, no evidence of soil contamination was found at the Rockford Products facility. Lack of property access, and the presence of building and utilities prohibited a more thorough characterization of the soils in Area 9/10. Soil data for Area 9/10 soil boring locations are shown on **Figure 2-5**. A volume estimate of contaminated soils was not performed for this area because of access considerations on the Sundstrand property.

Elevated TCA concentration in groundwater immediately down gradient of Sundstrand indicates the presence of NAPL because the measured concentrations exceeded the aqueous solubility limit of TCA by one percent. The potential existence of NAPL will influence the fate and transport of contaminants. Based on the presence of TCA and the subsurface characteristics in the area, DNAPL in Area 9/10 would migrate vertically downward to the clay layer at 130 feet and would then provide an ongoing source of VOCs to the aquifer.

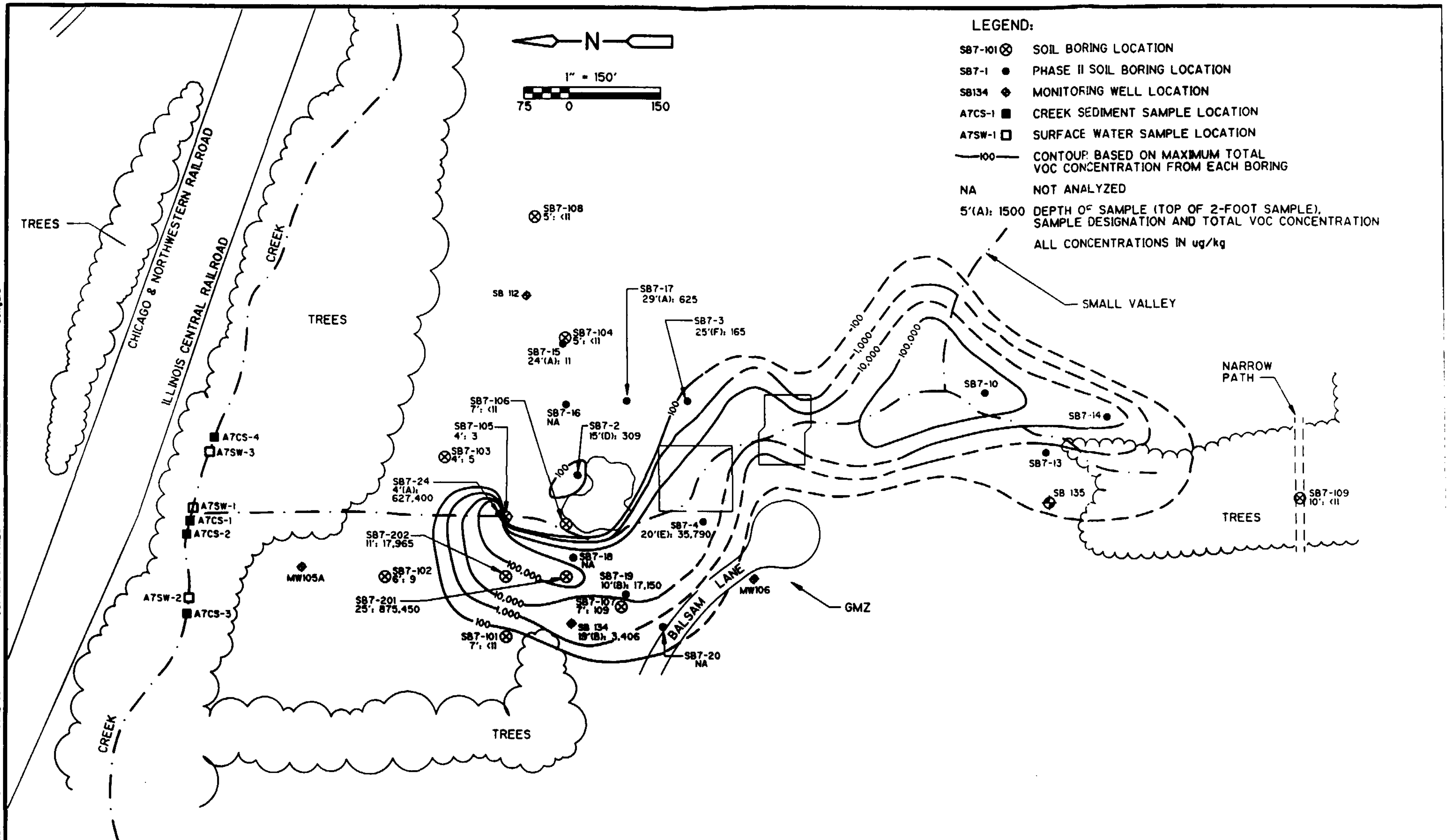

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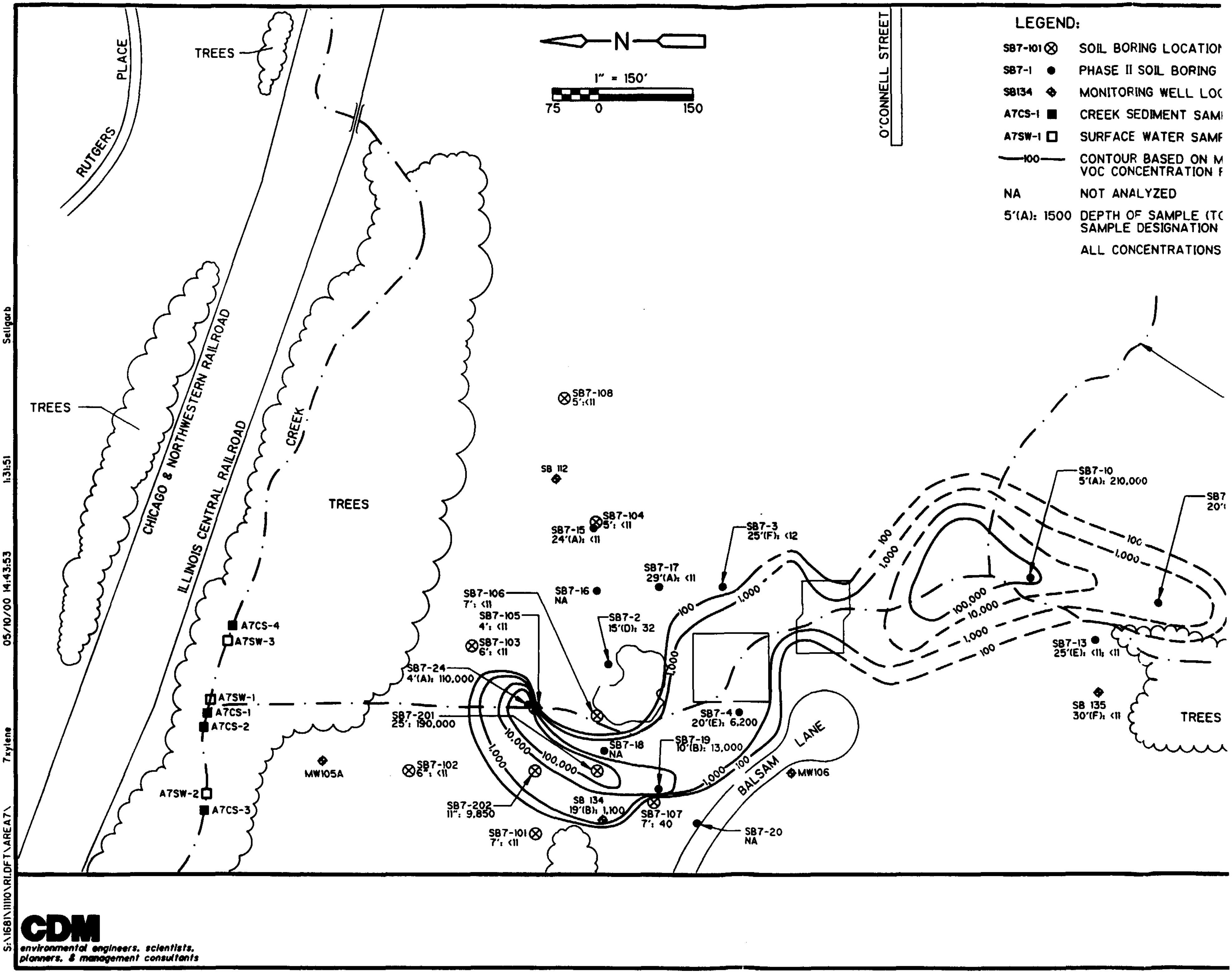
FIGURE No. 2-2
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY
AREA 7 TOTAL VOCs
IN SUBSURFACE SOILS



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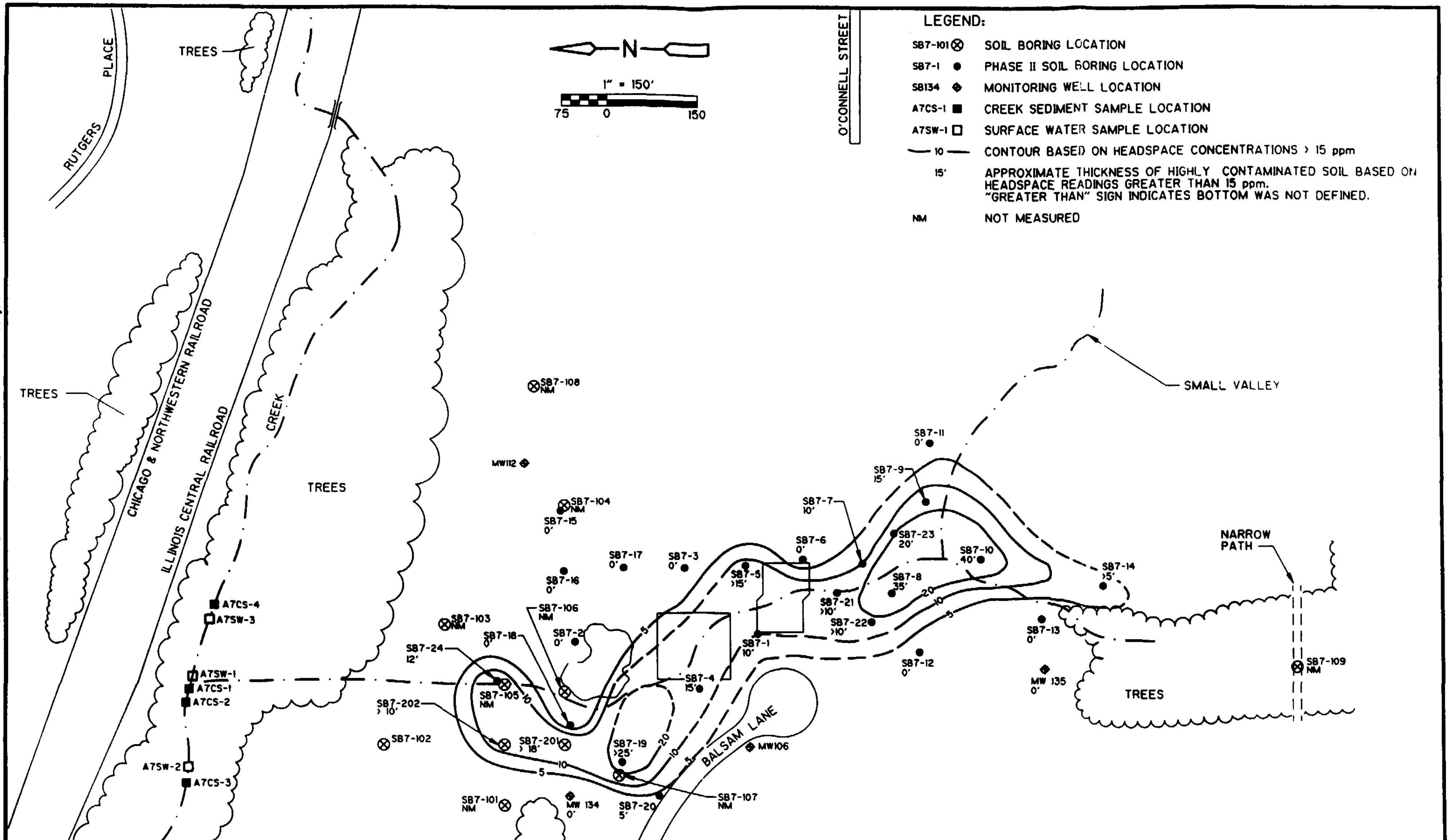

SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT

AREA 7 APPROXIMATE THICKNESS OF HIGHLY CONTAMINATED SOIL

Figure No. 2-4

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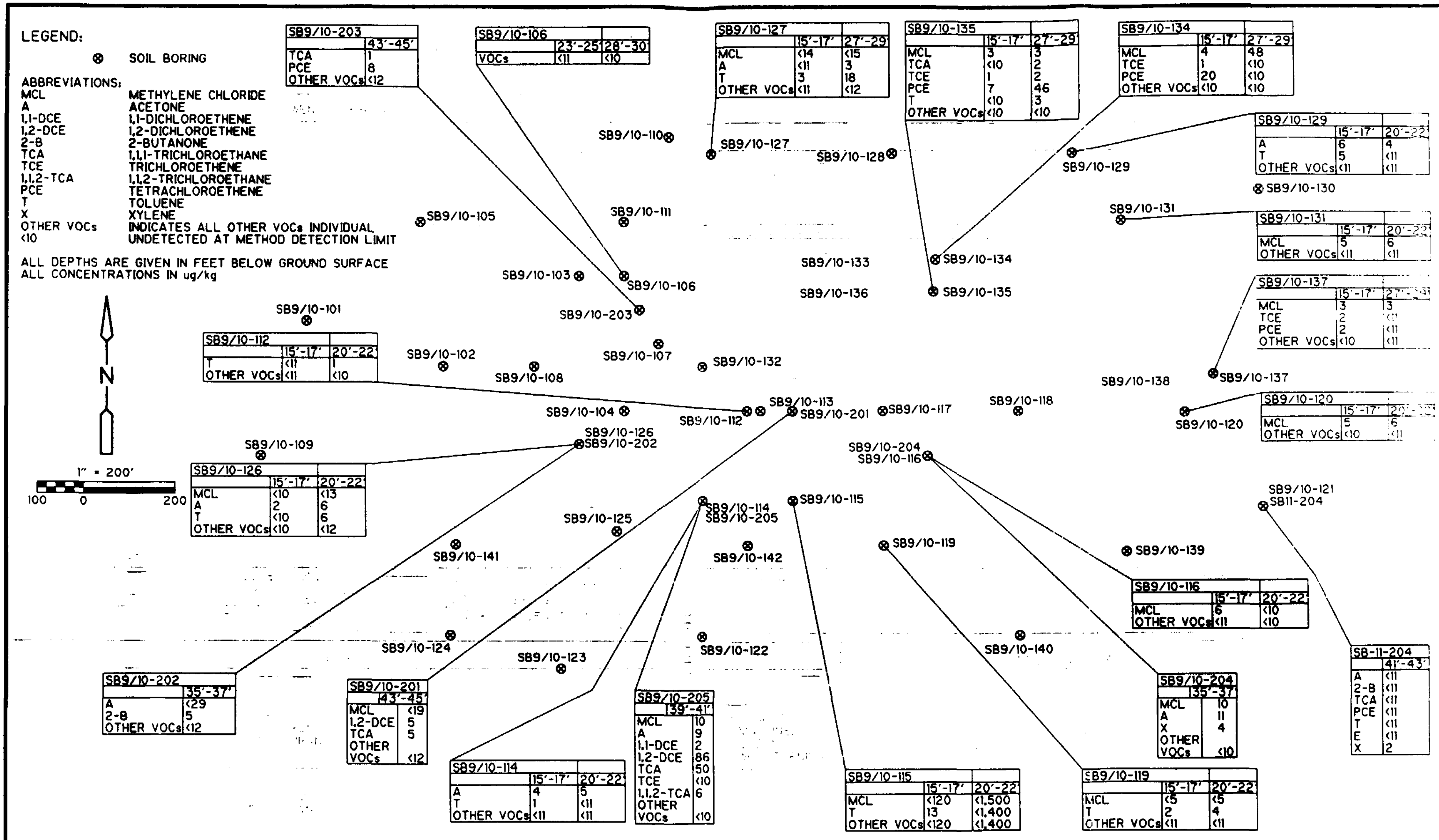
LEGEND:

⊗ SOIL BORING

ABBREVIATIONS:

MCL	METHYLENE CHLORIDE
A	ACETONE
1,1-DCE	1,1-DICHLOROETHENE
1,2-DCE	1,2-DICHLOROETHENE
2-B	2-BUTANONE
TCA	1,1,1-TRICHLOROETHANE
TCE	TRICHLOROETHENE
1,1,2-TCA	1,1,2-TRICHLOROETHANE
PCE	TETRACHLOROETHENE
T	TOLUENE
X	XYLENE
OTHER VOCs	INDICATES ALL OTHER VOCs INDIVIDUAL
<10	UNDETECTED AT METHOD DETECTION LIMIT

ALL DEPTHS ARE GIVEN IN FEET BELOW GROUND SURFACE
ALL CONCENTRATIONS IN ug/kg



SB9/10-203	43'-45'
TCA	1
PCE	8
OTHER VOCs	<12

SB9/10-106	23'-25'	28'-30'
VOCs	<11	<10

SB9/10-127	15'-17'	27'-29'
MCL	<14	<15
A	<11	3
T	3	18
OTHER VOCs	<11	<12

SB9/10-135	15'-17'	27'-29'
MCL	3	3
TCA	<10	2
TCE	1	2
PCE	7	46
T	<10	3
OTHER VOCs	<10	<10

SB9/10-134	15'-17'	27'-29'
MCL	4	48
TCE	1	<10
PCE	20	<10
OTHER VOCs	<10	<10

SB9/10-129	15'-17'	20'-22'
A	6	4
T	5	<11
OTHER VOCs	<11	<11

SB9/10-131	15'-17'	20'-22'
MCL	5	6
OTHER VOCs	<11	<11

SB9/10-137	15'-17'	27'-29'
MCL	3	3
TCE	2	<11
PCE	2	<11
OTHER VOCs	<10	<11

SB9/10-120	15'-17'	20'-22'
MCL	5	6
OTHER VOCs	<10	<11

SB9/10-112	15'-17'	20'-22'
T	<11	1
OTHER VOCs	<11	<10

SB9/10-126	15'-17'	20'-22'
MCL	<10	<13
A	2	6
T	<10	6
OTHER VOCs	<10	<12

SB9/10-116	15'-17'	20'-22'
MCL	6	<10
OTHER VOCs	<11	<10

SB-11-204	41'-43'
A	<11
2-B	<11
TCA	<11
PCE	<11
T	<11
E	<11
X	2

SB9/10-202	35'-37'
A	<29
2-B	5
OTHER VOCs	<12

SB9/10-201	43'-45'
MCL	<19
1,2-DCE	5
TCA	5
OTHER VOCs	<12

SB9/10-205	39'-41'
MCL	10
A	9
1,1-DCE	2
1,2-DCE	86
TCA	50
TCE	<10
1,1,2-TCA	6
OTHER VOCs	<10

SB9/10-204	35'-37'
MCL	10
A	11
X	4
OTHER VOCs	<10

SB9/10-114	15'-17'	20'-22'
A	4	5
T	1	<11
OTHER VOCs	<11	<11

SB9/10-115	15'-17'	20'-22'
MCL	<120	<1,500
T	13	<1,400
OTHER VOCs	<120	<1,400

SB9/10-119	15'-17'	20'-22'
MCL	<5	<5
T	2	4
OTHER VOCs	<11	<11

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SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT

AREA 9/10 SUBSURFACE SOIL DATA FOR SELECTED LOCATIONS

Figure No 2-5

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2.1.4 Area 11

Soil contamination in Area 11 is dominated by the aromatic VOCs ethylbenzene, toluene, and xylene (ETX), which are primarily located in the uppermost part of the saturated zone. This zone of ETX contamination extends from the east edge of the above-ground storage tank area west to 11th Street along a former railroad right-of-way, based on soil samples collected during the operable Unit RI (CDM 1995) and SCOU investigations. In addition, soil sampling during the SCOU investigation discovered significant ETX contamination at the northwest portion of the Rohr Manufacturing building, thereby extending the estimated area of contamination by another 150 feet northward. Residual NAPL was present at the water table within the soil pore spaces in soil borings adjacent to the west end of the Rohr Manufacturing building. It is likely that elevated ETX concentrations exist beneath the west end of the Rohr building. High ETX concentrations were not found west of 11th Street, approximately 120 feet from the Rohr facility. Chlorinated VOCs are present in Area 11 soils, however, elevated detection limits (> 10,000 ug/kg) caused by high ETX concentrations prevent accurate determination of VOC concentrations in the highly contaminated zones. Furthermore, based on the historic use of the source area chlorinated solvents are present in Area 11.

A rough estimate of the volume of contaminated soil was made based on all available data. As shown on **Figure 2-6**, the estimated western area of contamination (north & south of Rohr) is about 17,000 ft^2 and averages about 15 feet in thickness for a volume of 256,000 ft^3. If the area under the building is included, the total western area of contamination is approximately 375,000 ft^3. The estimated volume of contaminated soil around the above ground storage tank is 60,500 ft^3.

It is expected that the relatively higher concentrations of BETX compounds in the aquifer in Area 11 have created a reducing environment that fosters the degradation of VOCs. This results in the formation of locally high concentrations of degradation products such as vinyl chloride down gradient of the area. The historical groundwater VOC data corroborate the subsurface soil results and indicate migration through groundwater.

2.2 Summary of Risk Assessment

For the SCOU, a human health risk evaluation was performed for the entire site and an ecological risk evaluation was performed on Area 7.

2.2.1 Summary of the Human Health Risk Assessment of Soil in the Four Source Areas

For the Southeast Rockford Groundwater Contamination project, Illinois EPA and U.S. EPA considered separately the risk posed by drinking contaminated groundwater and the risk posed by the contaminated soil in the four source areas. In October 1995, after carefully considering public comment, the Illinois EPA and U.S.

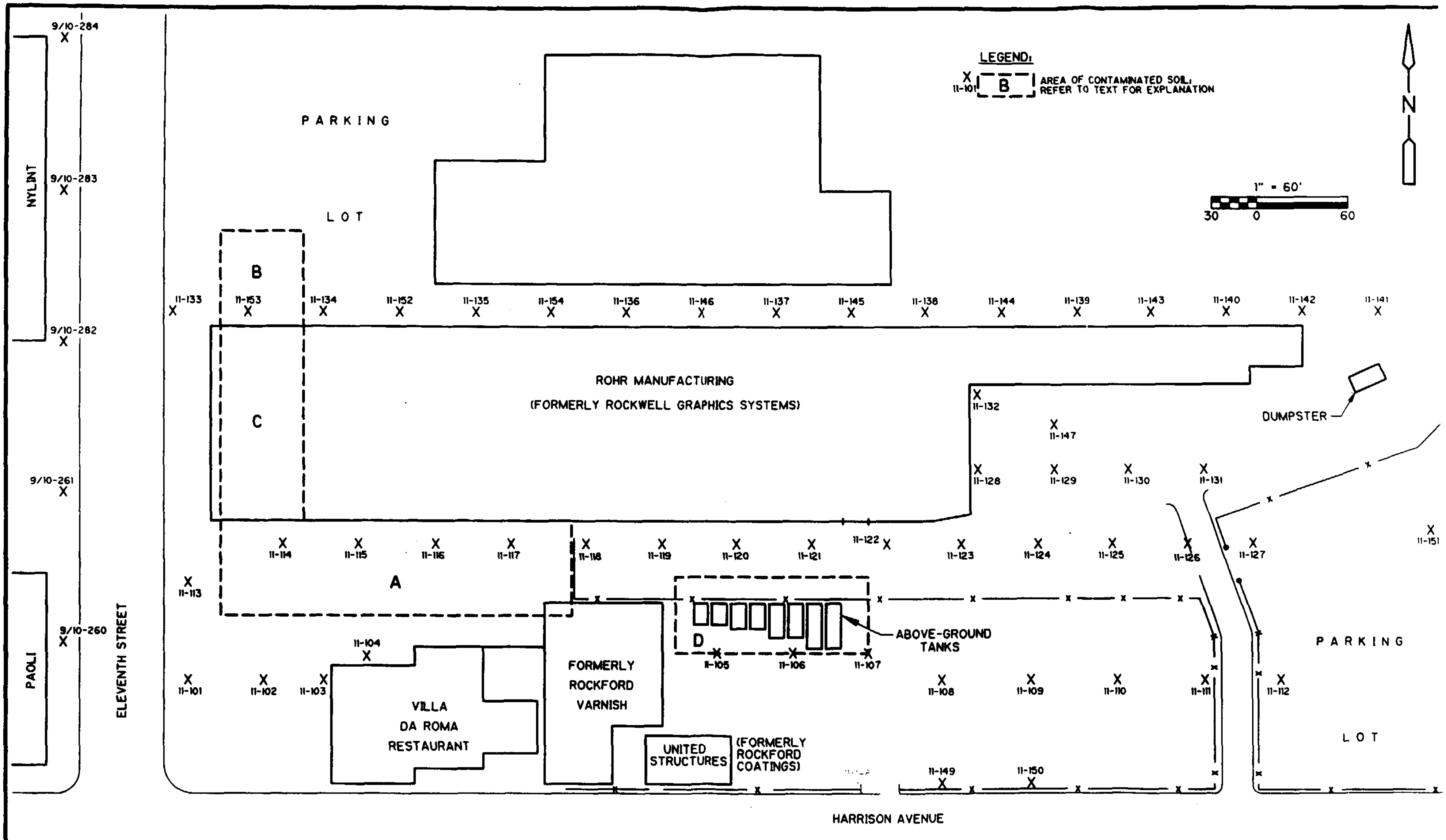

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FIGURE No. 2-6
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY
AREA 11 ESTIMATED AREA OF CONTAMINATED SOIL

EPA chose "Use Restrictions" as the remedy for the groundwater throughout the area that was predicted to be impacted by contaminated groundwater within the next 70 years. The remedy for the groundwater was implemented in 1998."

A human health risk assessment was conducted on the soil in each of the four source areas of the SCOU and the results are summarized below.

The human health risk assessment followed a tiered approach, in conformance with Tiered Approach to Corrective Action Objectives (TACO): 35 ILL.ADM.CODE PART 742. TACO is a set of State of Illinois regulations that specify methods for developing remediation goals and identifying chemicals of concern. TACO also provides guidance on associated issues such as the statistical evaluation of data, the collection and use of background data, and the establishment of compliance points.

TACO uses a three-tiered approach to identify chemicals of concern and develop remediation goals for those chemicals. TACO's first tier (Tier 1) is a set of tables listing pre-established screening values. These screening values can be used as soil remediation goals, or, for those chemicals with concentrations higher than the screening values, site-specific soil remediation goals can be calculated using the methods and procedures described in Tier 2 or Tier 3. At some sites, the use of Tiers 2 and 3 is preferable because they allow the use of less stringent remediation goals that are equally protective of human health. This is achieved through the use of existing data and characteristics which are more specific to the site, rather than the more conservative and general information used within Tier 1. A combination of Tiers 1 and 3 was used in this risk assessment. The soil remediation goals and conclusions reached in this risk assessment will be the basis for the FFS so that the chemical concentration levels remaining after the remedy is in place will meet the U.S. EPA requirements for protection of human health and the environment as described in 40 CFR 300.430 (e)(2) of the NCP. For more discussion on the use of TACO and the calculation of remediation goals, see Section 3.3 of this document and CDM's April 20, 2000 Source Control Operable Unit Risk Assessment Report.

Three exposure pathways were considered in this assessment: (1) direct contact with soil (including ingestion and inhalation); (2) the soil component of the groundwater ingestion pathway; and (3) ingestion of vegetables. A Tier 1 evaluation was conducted for the direct contact with soil pathway and the soil component of the groundwater pathway. Chemical concentrations found at the site were compared to a combination of Tier 1 pre-established screening values, background concentrations and practical quantitation limits (PQLs). A PQL is the level at which a chemical can be reliably measured in the laboratory.

A Tier 3 evaluation was also conducted for the soil component of the groundwater pathway (for chemicals which exceeded values established under Tier 1 assessment) and the ingestion of vegetables pathway for Area 7 only. Based on land use in this area, the close proximity of farmland, and the absence of institutional controls, it was determined that an agricultural scenario could not be ruled out.

Sampling data collected from surface and subsurface soil from each of the four source areas were compared to the Tier 1 Exposure Route-Specific Values (ingestion and inhalation) for soil protective of residential areas and the Soil Component of the Groundwater Ingestion Exposure Route Values for Class I groundwater. The direct contact (ingestion and inhalation) value are protective of direct contact with soil, while the soil component of the groundwater protection values are protective of groundwater impacted by contaminants that could leach from soil.

As directed by Illinois EPA, it was assumed that all four source areas were, or could become, residential areas. Currently, no land use restrictions are in place to prevent residential development or expansion, therefore, it was necessary to employ soil remedial objectives that would be protective of residential land use. Because the exposure assumptions for the residential scenario are standardized, with few site-specific modifications, there was no advantage to developing Tier 3 values for the residential scenario and Tier 1 values were used.

Because several chemicals exceeded Tier 1 objectives for soil that could impact groundwater, Tier 3 soil remediation objectives (SRO) were developed. The Tier 3 risk-based soil levels protective of groundwater are presented on **Table 2-1** for the chemicals of concern. The SRO is back-calculated from the Groundwater Remediation Objective (GRO) presented for Class I Groundwater in Section 742, Appendix B: Table F of TACO. While most of the GROs are based on a hazard index of 1.0 or a cancer risk of one in one million, in some cases, the GRO is based on a higher cancer risk. A mixture assessment was conducted according to the Illinois EPA mixture rule issued under Docket C of the Illinois Pollution Control Board (December 4, 1997) to determine what the risks would be if all of the SROs for the soil to groundwater pathway were achieved. This assessment demonstrated that, in accordance with TACO, total cancer risk associated with the SROs for the soil to groundwater pathway would not exceed an excess lifetime risk of one in ten thousand or a hazard index of 1.0 if all SROs were achieved.

<u>Result of the Direct Contact Pathway (Tier 1)</u>

The results of the Tier 1 assessment of the direct contact pathway can be summarized as follows:

1. Maximum concentrations of volatile organic compounds (VOCs) did not exceed their respective Tier 1 values in Areas, 4, 9/10, and 11. In Area 7, Trichloroethene and Tetrachloroethylene exceed their respective Tier 1 values in two locations.

Table 2-1
Risk-Based Soil Levels Protective of Groundwater for Each Area
Southeast Rockford Operable Unit

Comparison of Calculated Tier 3 Soil Remediation Objectives to Tier I (mg/kg)

Area 4	$RBSLatten_{area4}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
1,1,1-Trichloroethane	9.118	1084	2	510

Area 7	$RBSLatten_{area7p}$	$RBSLatten_{area7d}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
1,2-Dichloroethane	3.678	1787.000	1768	0.02	0.18
cis-1,2-Dichloroethene	0.941	11.500	1141	0.4	49
2,4-Dinitrotoluene	0.162	80.900	182	0.0008	1.5
Ethylbenzene	57.347	953.000	389	13	31
Methylene Chloride	1.15E+06	2.27E+12	2303	0.02	0.012
Tetrachloroethene	1.465	136	218	0.06	260
Toluene	337502367.730	3.74E+14	638	12	23
1,1,1-Trichloroethane	108.033	19622.000	1084	2	460
1,1,2-Trichloroethane	0.619	56.300	1784	0.02	0.46
Trichloroethene	0.310	7.200	1242	0.06	130
Xylenes (total)	34105.533	1.66E+07	312	150	210

Area 9/10	$RBSLatten_{area9/10c}$	$RBSLatten_{area9/10w}$	$RBSLatten_{area9/10ne}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
Methylene Chloride	3.26E+23	2.22E+12	4.13E+21	2303	0.02	0.048

Area 11	$RBSLatten_{area11}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
Benzene	0.189	824	0.03	1.5
Ethylbenzene	7.983	389	13	590
Methylene Chloride	4.79E+07	2303	0.02	2.9
2-Methylphenol	2.82E+23	16827	15	0.58
Toluene	1.06E+10	638	12	1400
Trichloroethene	0.051	1242	0.06	0.41
Xylenes (total)	24500.418	312	150	2,300

Notes:

RBSLatten refers to the degree of attenuation associated with a particular source area as calculated using the equation R15 of TACO. The soil remediation objective within this column takes the RBSLatten value into account. A remediation objective calculated using the RBSL is as protective as the Tier 1 value because the RBSL value considers site specific data as opposed to the statewide general data used to calculate the Tier 1 value.

C^s is the saturation concentration calculated using the equation S29 of TACO. If a chemical concentration exceeds this value, it may be present as a free product, and it is Illinois EPA policy to remediate free product if technically practicable.
SRO is the TACO Tier 1 soil remediation objective
The ultimate soil remediation objective for the protection of gorundwater is the lower of the RBSLatten concentration and the C^ssat value.
The exceptions are for ethylbenzene, trichloroethene, and total xylenes in Area 11, where the Residential Class 1 groundwater Tier 1 SRO is used instead

2. Maximum concentrations of semi-volatile organic compound (SVOCs) and inorganics exceeded their respective direct contact (ingestion and inhalation) Tier 1 values in all four areas.

3. Maximum concentrations of inorganics and one SVOC in Area 7, benzo (a) pyrene, were dropped from further evaluation because detected concentrations were less than or consistent with background concentrations. Risk associated with these chemicals are below 1E-06 (one in one billion) and/or a hazard index of 1.0.

4. Selected samples in Areas 4 (SS4-201, SS4-203, SS4-203D) and 11 (SS11-206, SS11-207) were identified as "hot spots" that exceeded a Tier 1 value and the Practical Quantitation Limit (PQL). Three out of four samples in Area 9/10 (SS910-101, SS910-103, SS910-104) exceeded one or more Tier 1 values. These data are presented in Appendix B. The "hot spots" in Areas 4 and 11 and the samples exceeding a Tier 1 value in Area 9/10 will be addressed in the FFS. The FFS will evaluate whether or not additional SVOC data may be needed in the remedial design phase to better characterize risk and the extent of contamination. Based on the results of sampling, if necessary, remedial alternatives that address SVOCs would be developed and evaluated. The presence of these hot spots represents a potential exceedance of risk limits established by U.S. EPA (a noncancer hazard index of 1.0 and cancer risks of between one in one million and one in one hundred thousand) and Illinois EPA (a noncancer index of 1.0 and cancer risks of one in one million used to develop the Tier 1 values) depending on actual exposure.

<u>Results of the Soil to Groundwater Pathway (Tier 1)</u>

The results of the Tier 1 assessment of the soil to groundwater pathway can be summarized as follows:

1. Several chemicals were dropped from further evaluation for the soil to groundwater pathway because they were not detected in groundwater (Dieldrin, carbazole and several SVOCs).

2. VOCs in surface soil in Area 4 and VOCs in subsurface soil in all four areas exceeded Tier 1 soil component of the groundwater protection values. These VOCs were further evaluated in Tier 3.

A Tier 3 assessment was conducted for those chemicals that exceeded a soil component of the groundwater protection value and were detected in groundwater during past sampling events at greater than 5 percent frequency of detection. The

Tier 3 assessment consisted of calculating soil concentration protective of groundwater at a designated point of compliance.

Results of the Soil Component of the Groundwater Ingestion Pathway (Tier 3)

The results of the Tier 3 assessment of the soil component of the groundwater ingestion pathway can be summarized as follows:

1. Chemicals of concern in Areas 4, 7, and 11 exceed their respective SROs. Two additional chemicals of concern in Area 11 exceed their respective saturation concentrations, but not the calculated SRO. Risks associated with chemicals that exceed an SRO in Areas 4, 7 and 11 exceed Illinois EPA cancer risk limits of one in one million or a hazard index of 1.0.

2. All areas where detected concentrations exceeded the lower of the SRO or saturation concentration were further evaluated in the FFS Volumes estimates were developed for these areas for excavation or remediation purposes.

Results of Homegrown Fruits and Vegetable Ingestion Pathway (Tier 3)

Area 7 borders land currently used for agricultural purposes, and no current zoning restrictions prevent conversion of some of the undeveloped portions of Area 7 to agricultural use. For these reasons, a semi-quantitative evaluation was conducted to determine whether the use of Area 7 for growing vegetables or fruits would result in an unacceptable risk to human health.

Based on this evaluation, it is concluded that ingestion of vegetables (or fruits which have a fresh weight consumption rate lower than vegetables, i.e., 88 mg/day) would not result in exceedance of either a hazard index of 1.0 or a cancer risk of 1E-06 (one in one million), which are the risk limits on which the Tier 1 values are based.

Conclusion

A combination of a Tier 1 and Tier 3 assessment was used to assess risks to human health. The Tier 1 assessment resulted in the identification of VOCs above Tier 1 values in Area 7, and SVOCs above Tier 1 values in Areas 4, 9/10, and 11. The Tier 1 assessment resulted in the identification of SVOCs above Tier 1 values in Areas 4, 9/10 and 11. If these SVOCs were removed, all remaining concentrations of SVOCs would be less than the higher of the PQL or Tier 1 concentration. The Tier 3 Assessment resulted in remediation goals for VOCs in all four-source areas. The Tier 3 concentrations were used to develop a remediation plan discussed in the FFS.

2.2.2 Summary of Ecological Risk Assessment of Soil in Area 7

Although the 1995 groundwater Record of Decision concluded that the contaminated groundwater did not pose a long-term environmental (ecological) risk to the Rock River, Illinois EPA is also required to consider the ecological risk of the contaminated soil in the source areas. However, TACO may not be used to established ecological remediation goals. Therefore, an ecological assessment was conducted at Area 7 per U.S. EPA guidelines. Ecological assessments were not conducted at Areas 4, 9/10, and 11 because site characteristics (consisting mostly of pavement and buildings) are not highly suitable as habitat for significant populations of plants and animals, and some residential corrective action objectives cannot be used because, as they are currently designed, TACO values only considered human health risk posed by contaminated soil and not environmental risk.

An Ecological Risk Assessment (ERA) was conducted at Area 7 to evaluate the likelihood that adverse ecological effects may occur or are occurring at a site as a result of exposure to single or multiple chemical stressors (CDM 2000). Risks result from contact between ecological receptors and stressors that are sufficiently long duration and of sufficient intensity to elicit adverse effects. The primary purpose of this screening-level ERA is to identify contaminants in surface water and sediment that can result in adverse effects to present or future ecological receptors.

This ERA is based primarily on a screening-level approach in which measured chemical concentrations in surface water and sediment are compared to relevant effect concentrations. This ERA is intended to provide information that can help establish remedial priorities and serve as a scientific basis for regulatory and remedial actions for the site.

The general approach used to conduct this ERA is based on site-specific information and on recent EPA guidance, primarily *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments* (EPA 1997a), supplemented by *Guidance for Ecological Risk Assessment* (EPA 1998).

Risks to ecological receptors are summarized below, within categories designated as LOW RISK and RISK. No sources of MODERATE or HIGH RISKS are identified for this ERA. The differentiation of LOW and NO RISKS is used to evaluate the *relative* risks associated with specific stressors compared to all other potential contributors to risks. These designations are based on both the quantitative risk estimates presented previously and best professional judgement.

<u>LOW RISK</u>

- *Sensitive aquatic biota* such as benthic invertebrates can be adversely affected by direct contact with *surface water* in the creek adjacent to Area 7. The only COPC of concern in water at this location is:

  1,1,1-trichloroethane

- *Similar organisms* may be additionally at risk from direct contact with creek sediments. Major sediment-associated COPCs at this location include:

  benzo(a)anthracene
  methoxychlor
  chrysene

NO RISK

- Aquatic and semi-aquatic organisms do not appear to be at significant risk from any other COPCs identified at this site.

- Consumers of aquatic and semi-aquatic organisms (e.g., piscivorous birds, omnivorous upper trophic level predators), represented by belted kingfisher and red fox, respectively, do not appear to be at significant risk.

Section 3 Remedial Action Objectives and Remediation Goals

3.1 Introduction

This section of the FFS report presents the remedial action objectives and remediation goals for the Southeast Rockford Site. Remedial action objectives are site specific qualitative statements which define the degree of cleanup necessary to protect human health and the environment. Remediation goals are the quantitative remediation objectives necessary to attain the remedial action objectives as developed by the risk assessment.

The remedial action objectives for each source area at the SCOU are based on levels of human and environmental exposure and associated risks posed by contamination within a source area and by contamination that may migrate from the source areas. The results of the Final Risk Assessment (CDM, 1998) identified the potential contaminants of concern and the affected media at each source area which pose an unacceptable risk to human health and the environment. The remedial action objectives herein consider:

- Site characteristics that delineate the fate and transport of contaminants and pathways of exposure;
- Human and environmental receptors; and
- The associated short and long-term human health and environmental effects posed by the chemicals of concern.

The remedial action objectives for each source area are presented below.

Remedial action objectives for soil and leachate were identified for Source Areas 4, 7, 9/10 and 11. A groundwater management zone (GMZ) or Waste Management Zone for Class I groundwater has been established for each source area, in accordance with criteria given in Illinois Administrative Code, Section 620.250. Class I groundwater is groundwater located 10 feet or more below the land surface which is designated for potable use (see 35 IAC 742, Section 620.210, Class I: Potable Resource Groundwater).

According to Section 620.250, the GMZ constitutes a three dimensional region containing groundwater being managed to mitigate contamination caused by the release of contaminants from the soil. In addition, guidance provided by Illinois EPA and U.S. EPA specified that ARARs must be met at the GMZ boundary. **Figures 3-1 through 3-4** present the locations of the GMZ for each source area. For Areas 4, 7 and

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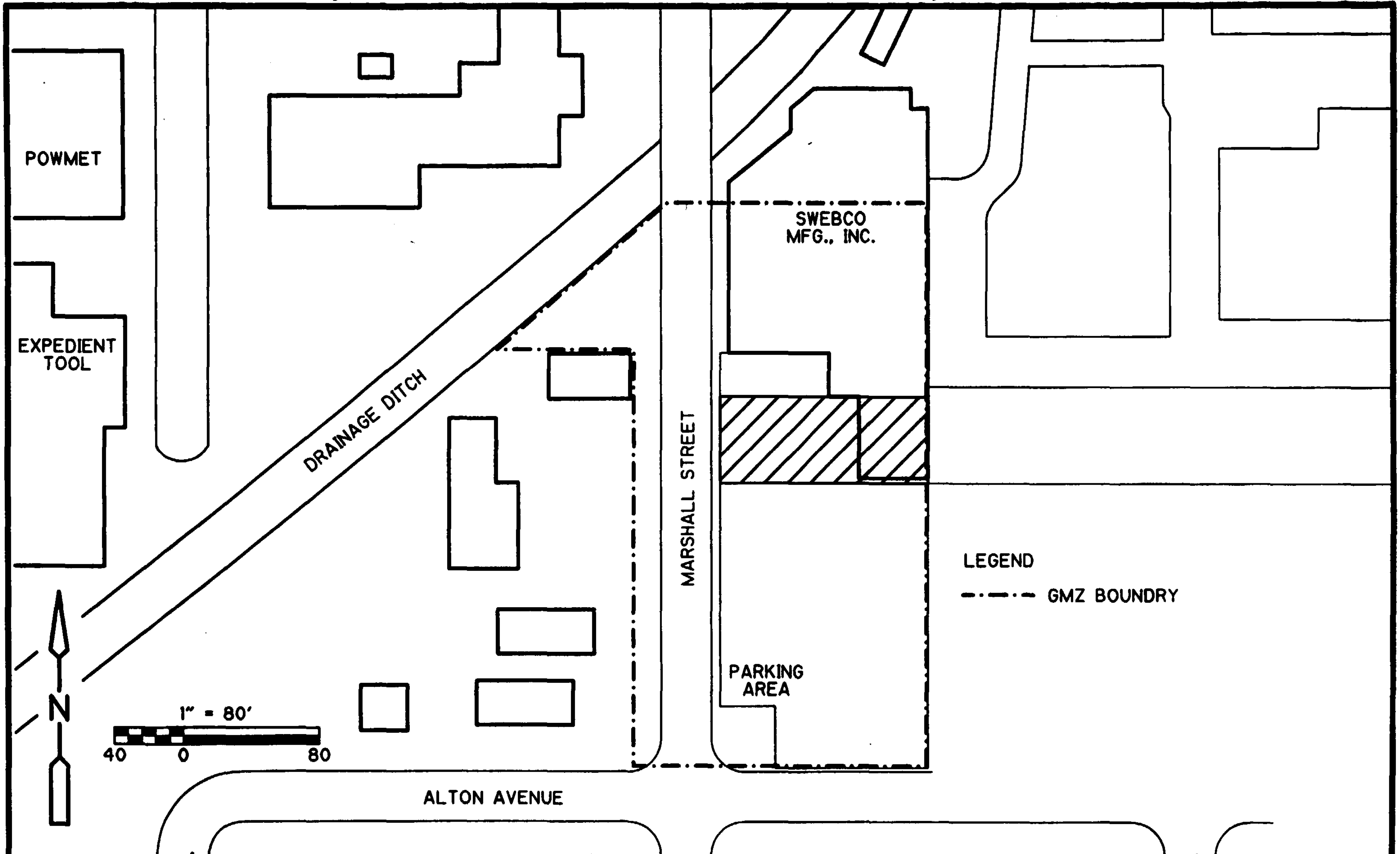

CDM
environmental engineers, scientists, planners, & management consultants

FIGURE No. 3-1
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
AREA 4 GMZ

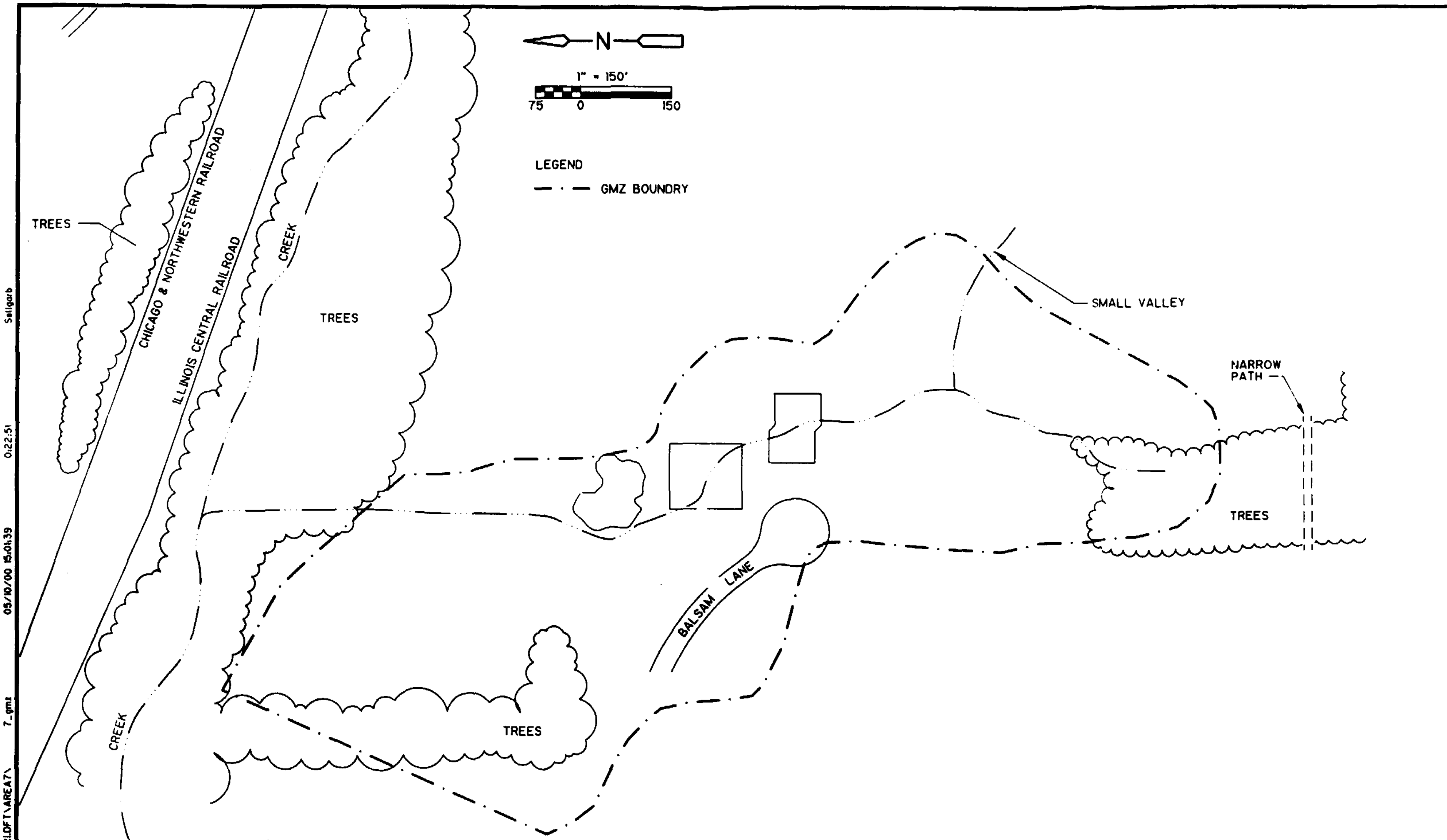

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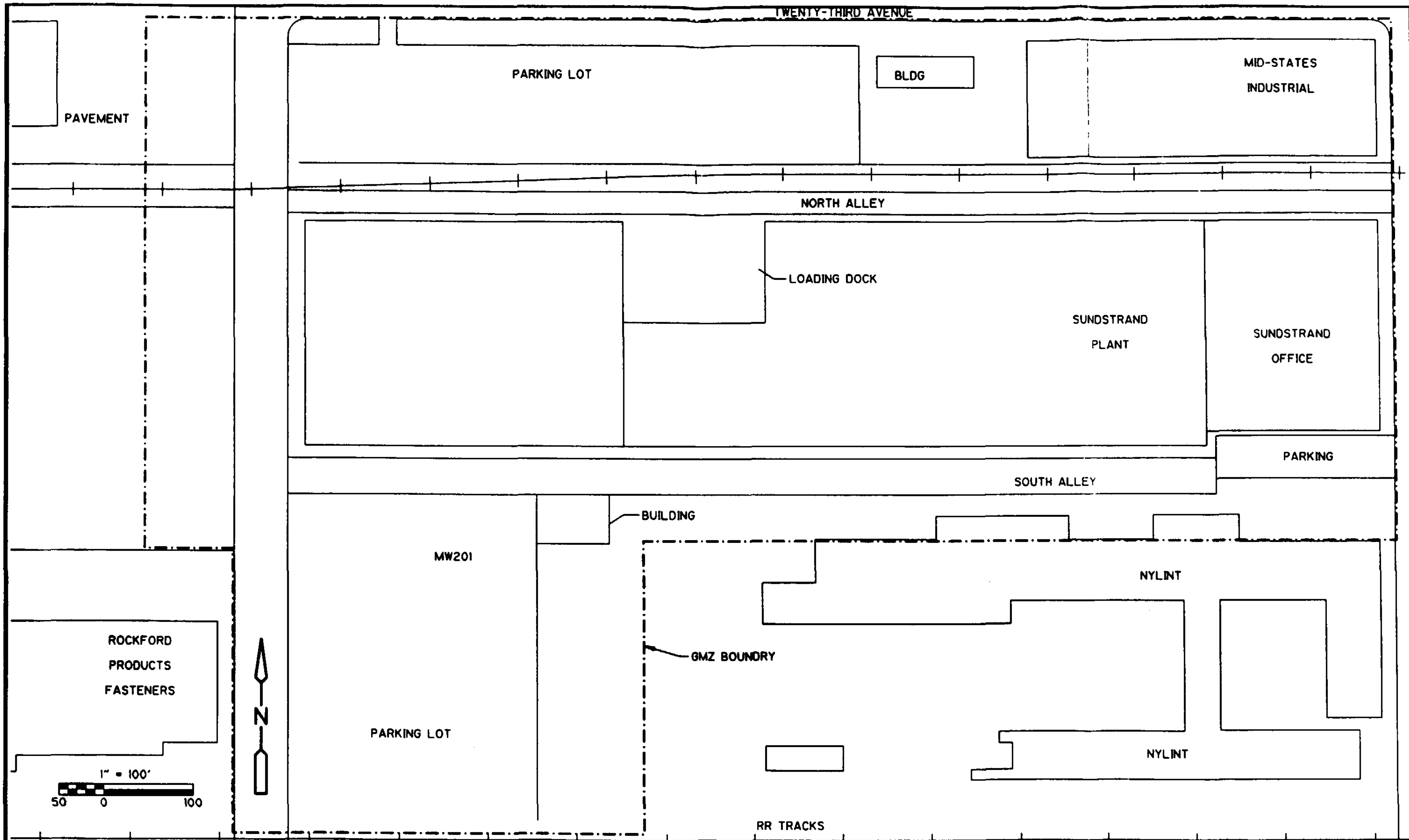
FIGURE No. 3-2
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY
AREA 7 GMZ



S:\1681\1110\RLEVL\ A-910gmz 05/10/00 15:04:09 0:08:30 Selgarb

FIGURE No. 3-3
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

AREA 9/10 GMZ

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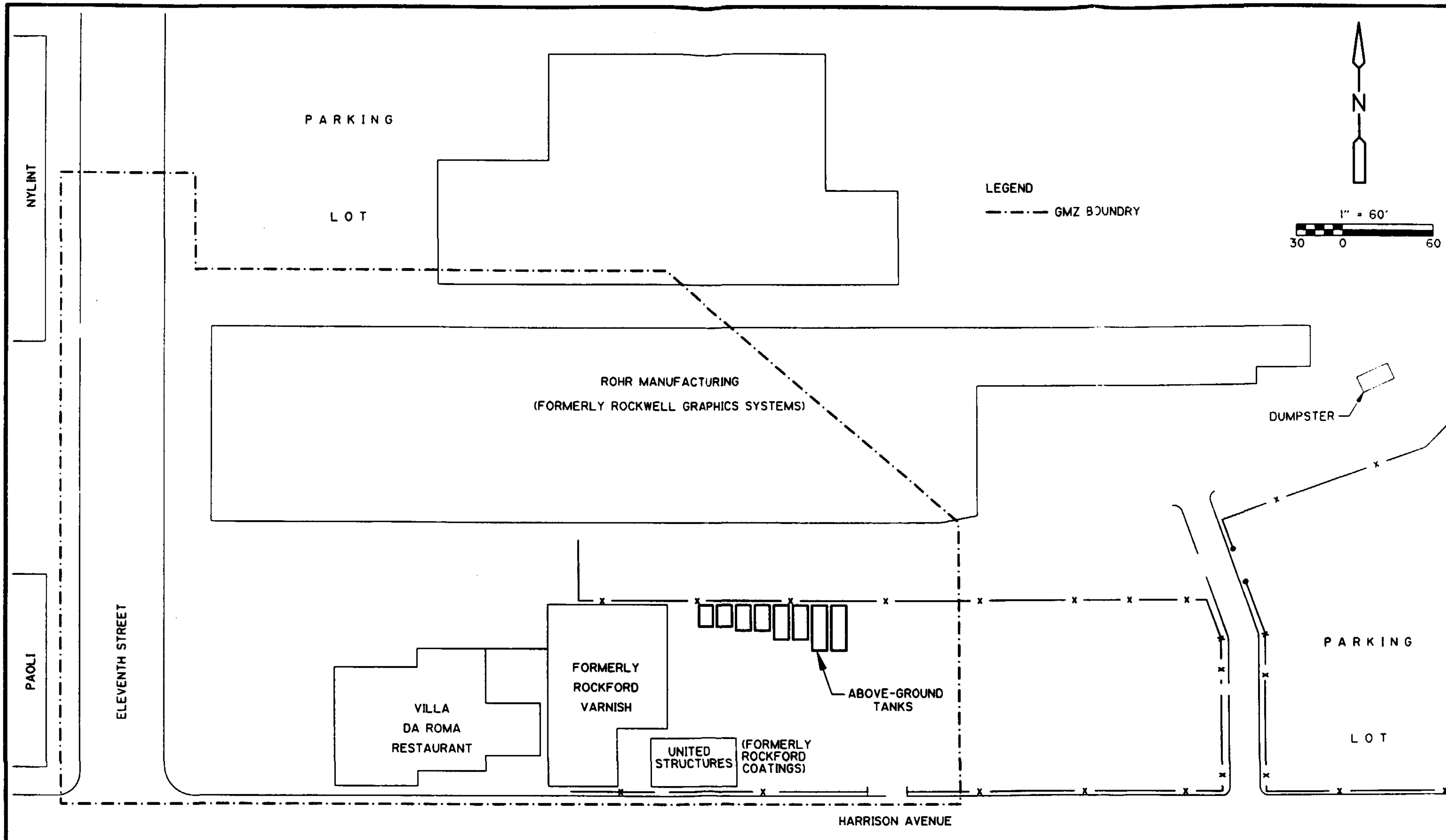

CDM
environmental engineers, scientists, planners, & management consultants

FIGURE No. 3-4
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
AREA 11 GMZ

11, the GMZ boundary corresponds to the region surrounding the soil source which is under the influence of soil remedial action and which can realistically achieve ARARs for groundwater at the boundary. For Area 9/10, where the extent of soil contamination is not as well defined, the GMZ boundary generally corresponds to the area surrounding Sundstrand Corporation's Plant #1, the former Mid-States Industrial property, and Rockford Products' property east of Ninth Street. The Area 9/10 GMZ encloses the general area where the soil source of contamination is suspected to be present.

3.2 Remedial Action Objectives

Remedial action objectives for each source area at the Southeast Rockford SCOU are as follows. It is noted that soils and leachate in each source area which exhibit characteristics of hazardous waste or is a hazardous waste will be removed or treated to non-hazardous levels.

- Area 4;
  - Prevent the public from incidental ingestion and direct contact with soil containing contamination in excess of federal and state soil standards or criteria, or which pose a threat to human health.
  - Prevent the public from inhalation of airborne contaminants in excess of federal and state air standards and criteria, or which may present a threat to human health.
  - Prevent the migration of contamination from the Source Area 4 that would result in degradation of site-wide groundwater or surface water to levels in excess of federal and state drinking water or water quality standards or criteria, or which pose a threat to human health or the environment, to the extent feasible and practical.
- Area 7;
  - Prevent the public from ingestion of and direct contact with soil/fill containing contamination in excess of federal and state soil standards or criteria, or which pose a threat to human health.
  - Prevent the public from incidental ingestion and direct contact with surface water containing contamination in excess of federal and state standards or criteria, or which pose a threat to human health.
  - Prevent the public from inhalation of airborne contaminants in excess of federal and state air standards and criteria, or which may present a threat to human health.

- Prevent the migration of contamination from Area 7 that would result in degradation of site-wide groundwater and surface water and sediment in Unnamed Creek to levels in excess of federal and state drinking water standards or criteria or which pose a threat to human health or the environment, to the extent practical and feasible.

- Prevent the migration of contamination from Area 7 that would result in contamination of homegrown vegetables at concentrations which pose a threat to human health.

■ Area 9/10;

- Prevent the public from ingestion and direct contact with soil containing contamination in excess of federal and state soil standards or criteria, or which pose a threat to human health.

- Prevent the public from inhalation of airborne contaminants (from disturbed soil) in excess of federal and state air standards or criteria, or which may present a threat to human health.

- Prevent migration of contamination from Area 9/10, that would result in continued degradation of site-wide groundwater or surface water to levels in excess of federal and state drinking water or water quality standards or criteria or which pose a threat to human health, to the extent practical and feasible.

■ Area 11;

- Prevent the public from ingestion of and direct contact with soil containing contamination in excess of federal and state soil standards or criteria, or which pose a threat to human health.

- Prevent the public from inhalation of airborne contaminants (from disturbed soil) in excess of federal and state air standards or criteria, or which pose a threat to human health.

- Prevent the migration of contamination, from Area 11 that would result in degradation of site-wide groundwater or surface water to levels in excess of federal or state drinking water or water quality standards or criteria or which pose a threat to human health, to the extent practical and feasible.

3.3 Applicable or Relevant and Appropriate Requirements (ARARs)

The remedies for the SCOU are subject to federal Applicable or Relevant and Appropriate Requirements (ARARs) and any more stringent state regulations. The determination of ARARs have been made in accordance with 121(d)(2) or CERCLA, as amended by the Superfund Amendments Reauthorization Act (SARA) of 1986. These ARARs are also consistent with the National Contingency Plan (NCP) 40 CFR Part 300; Amended March 8, 1990. ARARs are federal, or more stringent state requirements, that the remedial alternative(s) must achieve, that are legally applicable to the substance or relevant and appropriate under the circumstances. Administrative requirements such as obtaining permits and agency approvals, record keeping, reporting, and off-site activities such as waste disposal regulated by state or municipalities would also be considered applicable or relevant and appropriate regulations.

The status of a requirement under Section 121(d) of CERCLA and other environmental laws, both federal and state, may be either applicable or relevant and appropriate to the remedial alternative, but not both. The NCP (40 CFR 300.5) defines these terms as follows:

Applicable Requirements

Those clean-up standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

Relevant or Appropriate Requirement

Those clean-up standards, standards of control, and other substantive requirements, criteria or limitations described above, that, while not applicable, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well-suited to the particular site.

In addition to ARARs, the U.S. EPA has identified federal and state non-promulgated criteria, advisories and guidance as requirements to be considered (TBC) as part of the FS analysis. TBCs are used on an as appropriate basis in developing clean-up standards. TBCs do not have the same status as ARARs and are not considered to be required clean-up standards because they are not promulgated regulations.

Other Requirements to Be Considered (TBCs)

Non-promulgated federal and state advisories or guidance documents. These TBCs do not have status as potential ARARs; however, these advisories or guidance documents may be considered in determining the necessary level of clean-up for the protection of health or the environment.

As specified in 40 CFR 300.430(2), a remedial alternative that does not meet an ARAR under federal or state environmental laws can still be selected given any of the following six limited circumstances:

- The alternative is an interim measure and will become part of a total remedial action that will attain the applicable or relevant and appropriate federal or state requirement;
- Compliance with the requirement will result in greater risk to human health and the environment than other alternatives;
- Compliance with the requirement is technically impracticable from an engineering perspective (e.g., technically impracticability waiver for groundwater);
- The alternative will attain a standard or performance that is equivalent to that required under an otherwise applicable standard, requirement, or limitation through the use of another method or approach;
- With respect to a state requirement, the state has not consistently applied, or demonstrated the intention to consistently apply, the promulgated requirement in similar circumstances at other remedial actions within the state; and
- For Superfund-financed response actions only, an alternative that attains the ARAR will not provide a balance between the need for protection of human health and the environment with the availability of fund monies to respond to other sites that may present a threat to human health and the environment.

Type/Status of ARARs

ARARs are divided into three types of requirements: chemical specific, location specific, and action specific. This distinction is based on the factors that trigger the requirement (e.g., emission of a chemical or particular action such as transportation of a chemical). These types of ARARs are defined as follows:

Chemically Specific Requirements

Set health or risk-based concentration limits or ranges in various environmental media for specific hazardous substances, pollutants or contaminants that are acceptable in the ambient environment. Examples of chemical specific ARARs are National Ambient Water Quality Standards.

Location Specific Requirements

Set restrictions of activities depending on the characteristics of a site or its immediate receptors. A remedial alternative may be restricted or eliminated due to the location or characteristics of the site and the requirements that apply to it. Examples of location specific ARARs are regulations based on proximity to wetlands and flood plains.

Action Specific Requirements

Set controls or restrictions on particular kinds of activities related to the management of hazardous substances, pollutants, or contaminants. These requirements are not triggered by specific chemicals at a site, but rather by the particular activities to be conducted during the implementation of the remedial alternative (i.e., technology or activity based requirements). Examples of action specific ARARs are transportation and handling requirements.

Only chemical specific ARARs are candidates for site clean-up goals. Action specific and locations specific ARARs apply to the execution of the selected remedial alternative.

Identification of Potential Federal ARARs for the S.E. Rockford Site

This section presents a summary of those federal regulations which may be found to be applicable or relevant and appropriate to the S.E. Rockford site, specifically:

- Comprehensive Environmental Response, Compensation and Liability Act (CERCLA), including the Superfund Amendments and Reauthorization Act (SARA) of 1986 and subsequent amendments;
- Resource Conservation and Recovery Act (RCRA), including the Hazardous and Solid Waste Act Amendments of 1984 (HSWA);
- The Clean Water Act (CWA) and Amendments;
- The Safe Drinking Water Act (SDWA);
- The Clean Air Act (CAA);

- The Protection of Wetlands/Flood Plains Management Executive Order; and
- The Hazardous Materials Transportation Act.

The Comprehensive Environmental Response, Compensation and Liability Act

CERCLA, last amended in October 1992, provides the U.S. EPA Administrator the authority to respond to any past disposal of hazardous substances and any new uncontrolled releases of hazardous substances. Within CERCLA, a trust fund has been established for clean-up of abandoned past disposal sites and leaking underground storage facilities, as well as the authority to bring civil actions against violators of this act. The National Contingency Plan (NCP), which guides removal and remedial actions at Superfund sites, was developed subject to this act.

The Superfund Amendments and Reauthorization Act (SARA) of 1986 extensively amends CERCLA. The major goals of SARA were to include more public participation, and to establish more consideration of State clean-up standards, with an emphasis on achieving remedies that permanently and significantly reduce the mobility, toxicity, or volume of wastes.

The Resource Conservation and Recovery Act

RCRA regulates the management and land disposal of hazardous waste and solid waste material and the recovery of materials and energy resources from the waste stream. RCRA regulates the generation, transportation, treatment, storage, and disposal of hazardous wastes, as well as solid waste disposal facilities. RCRA applies to remedial actions selected that include disposal, treatment, storage, or transportation of regulated wastes. Remedies that include on-site disposal of hazardous wastes will be required to meet RCRA design, monitoring, performance (e.g., air emission standards 35 IAC 724) and closure standards. Off-site transportation of regulated wastes, whether as part of a remedial action or as generated during the investigation, will require use of the manifest system, a RCRA-licensed transporter, and proof of acceptance at a licensed facility approved for the particular wastes.

The Hazardous and Solid Waste Act Amendments (HSWA) of 1984 impose new and more stringent requirements on hazardous waste generators, transporters, and owner/operators of treatment, storage, and disposal facilities. Land disposal restrictions, as described in 40 CFR 268, identify hazardous wastes that are restricted from land disposal and define those limited circumstances under which an otherwise prohibited waste may continue to be land disposed.

The Clean Water Act

The Federal Water Pollution Control Act, amended by the Clean Water Act of 1977, was last amended October 1992, and is commonly referred to as the Clean Water Act (CWA). Federal Ambient Water Quality Criteria documents have been published for 65 priority pollutants listed as toxic under the CWA. These criteria are guidelines that may be used by states to set surface water quality standards. Although these criteria were intended to represent a reasonable estimate of pollutant concentrations consistent with the maintenance of designated water uses, states may appropriately modify these values to reflect local conditions. Under SARA, however, remedial actions must attain a level or standard of control that will result in surface water conditions equivalent to these criteria unless a waiver has been granted.

The water quality criteria are generally represented in categories that are aligned with different surface water use designations. These criteria represent concentrations that, if not exceeded in surface water, should protect most aquatic life against acute or chronic toxicity. For many chemical compounds, specific criteria have not been established because of insufficient data. The criteria are used to calculate appropriate limitations for discharges to surface water. These limitations are incorporated in the National Pollutant Discharge Elimination System (NPDES) permits.

The provisions of the CWA are potentially applicable to uncontrolled landfill leachate and groundwater discharges to surface water bodies and to remedial actions that include a discharge of treated water to surface water.

The Safe Drinking Water Act

The Safe Drinking Water Act of 1974 (SDWA), regulates the quality of water collected, distributed, or sold for drinking purposes. Standards are set for maximum contaminant levels (MCLs) permissible in water delivered to any user of public drinking water. The SDWA also has been broadened to protect groundwater and public drinking water supplies against contamination.

National primary drinking water standards established under the SDWA are promulgated as MCLs that represent the maximum allowable levels of specific contaminants in public water systems. MCLs are generally based on lifetime exposure to the contaminant for a 70 kg (154 pound) adult who consumes two liters (0.53 gallons) of water per day.

The SDWA provides for primary drinking water regulations to be established for maximum contaminant level goals (MCLGs), with MCLs as close to MCLGs as feasible. MCLGs are non-enforceable health goals at which no known or anticipated adverse effects on the health of persons would be expected to occur, thus allowing an adequate margin of safety. MCLGs only serve as goals for U.S. EPA in the course of setting MCLs and, therefore, are initial steps in the MCL rule-making process.

MCLs and MCLGs for contaminants of concern at the SCOU are established in the final Risk Assessment (CDM 1998).

The Clean Air Act

The Clean Air Act (CAA), with amendments through December 1991, was enacted to protect and enhance the quality of air resources to protect public health and welfare. The CAA is intended to initiate and accelerate national research and development programs to achieve the prevention and control of air pollution. Under the CAA, the Federal Agencies are to provide technical and financial assistance to state and local governments for the development and execution of their air pollution programs. The U.S. EPA is the administrator of the Act and is given the responsibility to meet the objectives of the Act. The Act establishes emission levels for certain hazardous air pollutants that result from treatment processes.

Requirements of the CAA are potentially applicable to remedial actions that result in air emissions, such as excavation and treatment activities.

The Protection of Wetlands/Flood Plain Management Executive Order

Executive Order 11990 requires Federal agencies in carrying out their responsibilities, to take action to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands. The order emphasizes the importance of the initiation of new construction located in wetlands unless there is no practicable alternative to that construction. The order also emphasizes minimizing the harm to the wetlands if the only practicable alternative requires construction in the wetland. The order requires that federal agencies provide early and adequate opportunities for public review of plans and proposals involving new construction in wetlands.

Executive Order 11988 requires federal agencies carrying out their responsibilities to take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by flood plains. This order emphasizes the importance of evaluating alternatives to avoid adverse effects and incompatible development in flood plains, minimizing the potential harm to flood plains if the only practicable alternative requires siting an action in a flood plain, and providing early and adequate opportunities for public review of plans and proposals involving action in flood plains.

Appendix A of 40 CFR Part 6 describes the requirements for flood plain/wetlands review of proposed U.S. EPA actions. These regulations are potentially applicable for work to be done in the creeks or other wetland areas, and for remedial activities within the flood plain, such as the unnamed creek in Area 7.

The Hazardous Materials Transportation Act

The Hazardous Materials Transportation Act (HMTA) of 1981, as amended, was enacted to regulate the shipping, marking, labeling, and placarding of hazardous materials that are transported on public roadways. Pursuant to the HMTA, the Department of Transportation (DOT) has promulgated regulations pertaining to transportation of hazardous materials. DOT also has jurisdiction over the packaging of hazardous materials prior to shipment.

Hazardous soils, residues, wastewaters, or wastes that are transported off-site from the SCOU site will be handled according to HMTA and DOT regulations.

Identification of Potential State ARARs for the S.E. Rockford SCOU

The purpose of this section is to identify ARARs that exist based on Illinois state regulations that must be complied with when performing a remedial action. The agency charged with developing and enforcing environmental regulations for Illinois is the Illinois EPA in conjunction with the Illinois Pollution Control Board. Specifically, these potential ARARs include:

- Illinois Groundwater Protection Act
- Illinois Solid Waste Management Rules; and
- Illinois Air Pollution Control Regulations

Illinois Groundwater Protection Act

The Illinois Groundwater Protection Act (IGPA) was enacted on November 7, 1991 (amended in 1994) by the Illinois General Assembly (IGA) as an outgrowth of long-standing concern by the IGA and the citizen's of Illinois that the State's rich and valued groundwater resources be protected. The IGPA is a multi-faceted groundwater policy and program statement designed to provide such protection and to assure the continued viability of the State's groundwater resources. In order to restore, protect, enhance and manage the groundwater of Illinois, the IGPA proposes regulations which establish comprehensive water quality standards specifically for the protection of groundwater.

Groundwater impacted by activities at the SCOU will be compared to the Illinois groundwater quality standards to determine the need for corrective actions, if any. The IGPA is incorporated into the Illinois Administrative Code in Title 35, Subtitle F

(Public Water Supplies), Part 620 Groundwater Quality; groundwater quality standards are given in Subtitle D of this Part 620.

Illinois Water Quality Standards (35 IAC Subtitle C: Water Pollution and Subtitle F: Public Water Supplies)

These regulations pertain to all waters in the state and are intended to restore and maintain the chemical, physical, and biological integrity of the waters of the state. The regulations include:

- Specific water quality standards and minimum treatment requirements that apply to all waters of the state (see Subtitle C: Part 302 water quality standards). These include minimum surface water quality standards, effluent standards and general use water quality standards.
- Regulations applying to industrial wastewater programs (National Pollutant Discharge Elimination System - NPDES);
- Regulations applying to municipal wastewater treatment facilities (Publicly Owned Treatment Works - POTW);
- Regulations applying to industrial wastewater discharges into sewage treatment plants;
- Water quality standards for water distributed through public water supply systems (Subtitle F, specifically). These include primary drinking water standards and groundwater monitoring requirements; and
- Groundwater quality standards for Class I-IV groundwater (defined in Subtitle F: Part 620) with potential for use in public water supply systems.

The procedures for developing water quality criteria based on toxicity are included in IAC Subtitle C: Part 302, Subpart F, as are procedures for evaluating the characteristics of receiving waters. These procedures are used to determine discharge concentrations which if not exceeded will maintain the quality of the receiving waters. Note that Subpart F: Section 620.130 exempts groundwaters from the General Use Standards or Public and Food Processing Standards of Subparts B and C of 35 IAC 302. It is the purpose of all of the mentioned water quality regulations to meet the requirements of Section 402 of the Federal Clean Water Act (CWA).

<u>Illinois Solid Waste Management Rules (35 Ill. Admin. Code Subtitle G: Waste Disposal)</u>

These regulations specify requirements that apply to solid waste and hazardous waste facilities. These include solid waste management requirements, hazardous waste management permitting and related hazardous waste operations requirements. The solid waste regulations are given specifically under Subchapter I: Solid Waste and Special Waste Handling, Parts 807-880. These regulations include design and disposal regulations as well as monitoring requirements and standards for groundwater protection applicable to solid waste and special waste landfills. The hazardous waste regulations were developed pursuant to the requirements of RCRA and are given specifically in Parts 700-750 of Subtitle G. These hazardous waste regulations pertain to generators and transporters of hazardous waste and owners or operators of hazardous waste facilities. Regulations regarding Underground Injection Control (UIC) and the handling of Universal Wastes are also included in this section.

Illinois Air Pollution Control Regulations (35 Ill. Admin. Code Subtitle B: Air Pollution)

The Illinois air pollution control regulations were developed pursuant to the Federal Clean Air Act (CAA). The regulations contain specific emission levels and requirements for monitoring emissions. They contain regulations for specific types of operations (such as burning) and types of industry as well as permitting requirements. There are also specific emissions standards for hazardous air pollutants. Subchapter F, Part 232 provides information regarding toxic air contaminants and Subchapter L, Part 243 of these regulations give Air Quality Standards.

Identification of ARARs

The regulatory groups described previously were considered during the ARAR identification process. This includes Federal and State of Illinois requirements (applicable or relevant and appropriate). Other information to be considered (TBCs) include Federal and State of Illinois criteria, advisories, and guidance documents. The summary identification of ARARs presented in this section was based on current knowledge of the site, available analytical data and review of ARARs established for sites with similar contamination. The ARARs from other sites were derived by reviewing EPA RODs from sites both within and outside of Region V based on remedial alternatives selected and final ARARs chosen for these sites.

Table 3-1 provides a summary of potential ARARs at the SCOU. Based on the anticipated remedial actions at the site (see Section 7), some of these potential ARARs may not apply. Those that potentially do not apply are marked in the last column of **Table 3-1**. The ARARs that will apply have a direct effect upon the remedial actions selected. The following paragraphs discuss some examples of this direct effect.

NPDES, Illinois Underground Injection Control (UIC), and Illinois Air Emission Source Construction permits can be obtained but may take considerable time. The Illinois EPA Division of Air Pollution Control will require off-gas containment of any air stripper that exceeds a total volatile emission rate of 8 lb/hour. Any groundwater that is remediated will require treatment to MCLs or IGWPA levels, whichever is more stringent; or to NPDES discharge levels depending on the discharge option selected. MCLs and IGWPA Class I Groundwater Standards for all VOCs that exceed MCLs in groundwater are provided in **Table 3-1**. In addition, **Table 3-1** summarizes potential NPDES discharge levels.

The IGWPA was set up in 1987 to respond to the need to manage groundwater quality by prevention oriented processes. It establishes comprehensive water quality standards for groundwater, provides for the use of water well protection zones, and allows for the establishment of groundwater management zones (GMZs) within any class of groundwater. A GMZ can be established where groundwater is being managed to mitigate against effects caused by the release of contaminants from a site. GMZ provisions recognize the practical limitations commonly associated with remediating groundwater contamination and links technological approaches and practices with standards regulation. The area of a GMZ can be established with reference to a given point of compliance and an appropriate period of time to achieve compliance. The groundwater within the study area is considered Class I groundwater under the definitions provided by the Act.

Privately-owned Treatment Works (POTWs) are designated to treat domestic wastewater or sewage. In general, POTWs are not designated to treat heavy metals, solvents, organics, and other types of toxic pollutants. POTWs are certainly not for "offsite" treatment or "disposal" of contaminated groundwater. The treatment of toxic pollutants, if it occurs at all in a POTW treatment plant, is incidental to the design of most POTWs and involves, to a large extent, taking advantage of the treatment system's ability to dilute non-domestic or industrial discharges, as well as adsorption of toxic pollutants to particles that settle out into the sludge. Thus, a significant portion of the heavy metals and organic compounds that are introduced into the headworks of a POTW treatment plant end up in the POTWs sewage sludge. Therefore, this FFS has assumed that discharge to the POTW is not acceptable. It is noted that the local POTW has indicated that it would not accept any contaminated leachate collected from the SCOU.

Table 3-1
Summary of Potential ARARS
Southeast Rockford SCOU Focused Feasibility Study

Act/Regulation	Federal or State	Type of ARAR	Parameter/ Program	Description	Probably Will Not Apply
Action Specific					
Air Pollution Emission Control Regs. (63)	S	Action	Air emission	Permit required for all emissions. Requires control of off-gas if emission > 8 lbs/hr	
Air Pollution Control Board (64)	S	Action	Air emission	No person shall cause or threaten or allow the discharge or emission of any contaminant	
Air Pollution Control Board (65)	S	Action	Air emission	Regulates particulate matter emissions	
CWA(50)	F/S	Action	NPDES	Discharge permit required (to Rock River)	
CWA/RCRA (49-51)	F/S	Action	POTW	Regulates discharge to POTW	X
CWA(49)	F	Action	NPDES	POTW pre-treatment standards relating to Superfund site leachate	
CWA(56)	F	Action	NPDES	Establishes Water Quality Based Effluent Limitations	
CWA(50)	F	Action	National pre-treatment standards	Discharge to POTW restrictions	
CWA(51)	F/S	Action	National pre-treatment standards	National pre-treatment program requirements for POTWs	
CAA(34)	F	Action	Air quality	Sets max. primary and secondary 24-hour particulate concentrations	

( ) indicates the regulation citation listed on pages 25-33

Table 3-1
Summary of Potential ARARS
Southeast Rockford SCOU Focused Feasibility Study

Act/Regulation	Federal or State	Type of ARAR	Parameter/ Program	Description	Probably Will Not Apply
CWA(52)	F/S	Action	NPDES	Permit must include proposed action and list all other permits	
CWA(53)	F/S	Action	NPDES	Establish standards, limitations and other conditions	
CWA(54)	F	Action	NPDES	BAT for toxic and non-conventional wastewater or BCT for conventional	
CWA(61)	F	Action	Env. sampling	Requires adherence to sample preservation, container type, and holding times	
CWA(56)	F/S	Action	NPDES	Effluent limitations and standards; permit requirements for discharge to storm sewer	
CWA(57)	F/S	Action	NPDES	Establish discharge limits for toxins exceeding BAT/BCT standards	
CWA(60)	F/S	Action	Surface water	States granted enforcement jurisdiction over discharges to surface waters	
CWA(58)	F/S	Action	NPDES	Requires monitoring to ensure compliance	
DOT(36)	F	Action	Haz. mat. transportation	Procedures for packaging, labeling and transportation of hazardous materials	

Table 3-1
Summary of Potential ARARS
Southeast Rockford SCOU Focused Feasibility Study

Act/Regulation	Federal or State	Type of ARAR	Parameter/ Program	Description	Probably Will Not Apply
Fish and Wildlife Coordination Act(62)	F	Action	Surface Water	Any fed. agency must consult U.S. Fish and Wildlife if a surface water body is modified	
Noise Control Act(37)	F	Action	Construction noise emission standards	Sets standards for construction noise emissions	
Protection of Archeological Resources(38)	F	Action	Archeological resource protection	Procedures for archeological resource protection	X
RCRA	F/S	Action	UIC	Regulates injection of groundwater	X
RCRA(48)	F/S	Action	T & D standards	Interim storage or treatment of haz. waste in containment buildings	
RCRA(47)	F/S	Action	T & D standards - haz waste storage	Standards for haz. waste storage in containers, surface impoundments and landfills	
RCRA(46)	F/S	Action	T & D standards	Requirements for closure and post-closure of haz. waste facilities	
RCRA(45)	F/S	Action	T & D standards - groundwater	Requirements for groundwater monitoring program	
RCRA(44)	F/S	Action	T & D standards	Sets standards for T & D facility storage and treatment, design, emergency and preparedness plans	
RCRA(43)	F/S	Action	UST regs.	Sets requirements for UST closure	
RCRA(42)	F/S	Action	RCRA land disposal restriction	Defines haz. waste debris and applies to wastes disposed off-site	

Table 3-1
Summary of Potential ARARS
Southeast Rockford SCOU Focused Feasibility Study

Act/Regulation	Federal or State	Type of ARAR	Parameter/ Program	Description	Probably Will Not Apply
RCRA(41)	F/S	Action	T & D standards	Sets requirements for haz. waste man. unit closure	
RCRA(40)	F/S	Action	Haz. waste transport and disposal (T & D)	Sets standards for haz. waste generators and transporters	
RCRA(39)	F/S	Action	Land disposal of solid waste	Solid, nonhaz. remediation derived waste disposal procedures	
UIC Regulations (72-74)	S	Action	UIC	Permit and controls required	
Illinois Groundwater Protection Act (79)	S	Action/ Chemical	Groundwater	Establishes groundwater management zones	
RCRA (69)	F/S	Action/ Chemical	Spent Carbon	Manifest/Transport / Regenerate Spent Carbon	
Chemical Specific					
CAA(1)	F	Chemical	Air emission	Sets regs. On national primary and secondary air quality standards	
CWA(2)	F/S	Chemical	Water quality	Establishes water quality standards	
Air Pollution Control Board(8)	S	Chemical	Air permits and provisions	Lists provisions for new sources requiring permits	
Air Pollution Control Board(9)	S	Chemical	Air permits and provisions	Defines emission sources and sets limitations	
Air Pollution Control Board(10)	S	Chemical	Air permits and provisions	Sets air quality standards and measurement methods for lead, CO, nitrogen and sulfur oxides	

Table 3-1
Summary of Potential ARARS
Southeast Rockford SCOU Focused Feasibility Study

Act/Regulation	Federal or State	Type of ARAR	Parameter/ Program	Description	Probably Will Not Apply
Air Pollution Control Board(11)	S	Chemical	Air permits and general provisions	Sets provisions and procedures for id. and evaluating toxic air contaminants	
Air Pollution Control Board (12)	S	Chemical	Air emissions	VOM emissions limited to <20 ppm	
Air Pollution Control Board (13)	S	Chemical	Air emissions	CO emissions from incinerators limited to <500 ppm	
CAA (1)	F	Chemical	VC	VC emissions limited to <10 ppm	
Public Water Supplies Poll. Control Board(20)	S	Chemical	Primary Drinking Water Standards	MCLs, primary drinking water standards, analytical requirements	
Public Water Supplies Poll. Control Board(19)	S	Chemical	Illinois Groundwater Quality	Illinois groundwater quality standards, class designations	
SDWA (3)	F	Chemical	MCLs	Sets MCLs for public drinking water	
RCRA(5)	F/S	Chemical	Solid Waste	Sets criteria for identifying haz. waste	
RCRA(4)	F/S	Chemical	Solid waste	Sets treatment standards for waste extract incl. hazardous waste	
RCRA(6)	F/S	Chemical	Solid Waste	Identifies charac. of haz. waste	
RCRA(7)	F/S	Chemical	Solid Waste	List of haz. waste from sources	
Waste Disposal Pollution Control Board(76)	S	Chemical	Solid waste and special waste hauling	Solid waste permitting, san. landfill closure and post-closure, and waste classification	

Table 3-1
Summary of Potential ARARS
Southeast Rockford SCOU Focused Feasibility Study

Act/Regulation	Federal or State	Type of ARAR	Parameter/ Program	Description	Probably Will Not Apply
Waste Disposal Pollution Control Board(16)	S	Chemical	Hazardous waste landfill disposal	Describes haz. waste restrictions on halogenated solvents and liquid wastes	
Waste Disposal Pollution Control Board(17)	S	Chemical	Hazardous waste lists and criteria	Solid waste permitting, sanitary landfills, closure & post closure care, and special waste classifications	
Waste Disposal Pollution Control Board(14)	S	Chemical	Hazardous waste lists and criteria	Identifying and listing hazardous waste (includes PCB wastes under TSCA)	
Waste Disposal Pollution Control Board(15)	S	Chemical	Hazardous waste landfill disposal	Defines landfill waste disposal restrictions, treatment standards and prohibitions	
Water Pollution Control Board(19)	S	Chemical	Effluent Standards	General and temp. effluent standards incl. NPDES	
Water Pollution Control Board(18)	S	Chemical	Water Quality Standards	Water quality criteria, public and food processing water supply	X
Location Specific					
CWA(22)	F	Location/Action	Wetland dredge and fill permits	Requires no wetland alteration if practical alternative available	X
Air Pollution Control Board(30)	S	Location	Air emissions standards	Distinguishes air emission standards for Chicago and Metro East Area	
Air Pollution Control Board(29)	S	Location	Construction permitting	Application for construction and operating permits including review	X

Table 3-1
Summary of Potential ARARS
Southeast Rockford SCOU Focused Feasibility Study

Act/Regulation	Federal or State	Type of ARAR	Parameter/ Program	Description	Probably Will Not Apply
Fish and Wildlife Coordination Act(23)	F	Location	Water body modification	Any federal agency must consult U.S. Fish and Wildlife prior to water body modification	
Flood Control Act(27)	F	Location	Flood plain construction	Req. approval for any construction in floodway outside Superfund boundary	
NEPA(25)	F	Location	Floodplain Management	Req. fed. agencies to mitigate flooding and preserve flood plains	
NEPA(24)	F	Location	Protection of Wetlands	Requires federal agencies to minimize degradation and preserve wetlands	
RCRA(27)	F/S	Location	100 year floodplain	Controls type of construction in 100 year floodplain	X
Waste Disposal Pollution Control Board(31)	S	Location	RCRA permit	RCRA permit application rules, applicability and information	
Water Pollution Control Board(33)	S	Location	NPDES and water related permitting	Includes NPDES permit provisions and other water related permitting	
Water Pollution Control Board(32)	S	Location	Water use and site specific standards	Establishes site specific water quality standards in Illinois	

Chemical Specific Requirements

Federal

(1) Clean Air Act (42 USC 7401 et seq.), National Primary and Secondary Ambient Air Quality Standards (40 CFR 50) *[U.S. EPA regulations on National Primary and Secondary Ambient Air Quality Standards]*.

(2) Clean Water Act (33 USC 1251, et seq.), Water Quality Standards (40 CFR 131) [U.S. *EPA regulations on establishing water quality standards*].

(3) Safe Drinking Water Act (42 USC 300f, et seq.), Maximum Contaminant Levels (40 CFR 141.11 - 141.16) [*Sets standards for contaminants in public drinking water supplies]*.

(4) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Land Disposal Restrictions (40 CFR 268) Subpart D, Treatment Standards *[Sets the treatment standards for waste extract, specified technology, hazardous waste debris]*.

(5) Solid Waste Disposal Act, (15 USC 6901, et seq.), Identification and Listing of Hazardous Waste (40 CFR 261) Subpart B, Criteria for Identifying the Characteristics of Hazardous Waste and for Listing Hazardous Waste *[Sets criteria for identifying a hazardous waste]*.

(6) Solid Waste Disposal Act, (15 USC 6901, et seq.), Identification and Listing of Hazardous Waste (40 CFR 261) Subpart C, Characteristics of Hazardous Waste *[Identifies the characteristics of a hazardous waste]*.

(7) Solid Waste Disposal Act, (15 USC 6901, et seq.), Identification and Listing of Hazardous Waste (40 CFR 261) Subpart D, List of Hazardous Waste *[List of hazardous waste from sources]*.

State

(8) Air - Pollution Control Board (Title 35), Subtitle B - Subchapter A, Part 201: Permits and General Provisions [*Lists general provisions for new sources requiring permitting. Exemptions from permit requirement are also given*].

(9) Air - Pollution Control Board (Title 35), Subtitle B - Subchapter C Emission Standards and Limitations for Stationary Sources, Part 211: Definitions and General Provisions [*defines emission sources and related items]*; Part 212 Visible and Particulate Matter Emissions [*Sets emission limitations for particulate matter for a variety of operations, i.e., incinerators or waste storage piles]*. Also see Parts 214-219 which gives information regarding specific types of emissions per operation (e.g., sulfur, organic material, carbon monoxide and nitrogen oxide emissions).

(10) Air - Pollution Control Board (Title 35), Subtitle B - Subchapter L, Part 243: Air Quality Standards [*Sets air quality standards and measurement methods for PM-10, particulates, sulfur oxides, carbon monoxide, nitrogen oxides, ozone and lead*].

(11) Air - Pollution Control Board (Title 35), Subtitle B - Subchapter F, Part 232: Toxic Air Contaminants [*Sets provisions and procedures for identifying and evaluating toxic air contaminants; exceptions are also given here*].

(12) Air – Pollution Control Board (Title 35), Subtitle B – Air Pollution, Part 215: Organic Material Emissions Standards and Limitations [*Sets emission standards for volatile organic material for a variety of operations*].

(13) Air – Pollution Control Board (Title 35), Subtitle B – Air Pollution, Part 216: Carbon Monoxide Emissions [*Sets emission standards for carbon monoxide for a variety of operations*].

(14) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, *Part 721*: Identification of Listing of Hazardous Waste [*includes PCB wastes regulated under TSCA, universal wastes, criteria for identifying and listing hazardous waste, and lists of hazardous waste*].

(15) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, Part 728: Land Disposal Restrictions [*defines land disposal restrictions for wastes, waste specific prohibitions, treatment standards, and prohibitions on storage*].

(16) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, Part 729: Prohibited Hazardous Wastes in Land Disposal Units [*describes general hazardous waste restrictions and restrictions on halogenated solvents and liquid hazardous wastes in landfills*].

(17) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter I: Solid Waste and Special Waste Hauling [*Part 807 includes information on solid waste permitting, sanitary landfills and closure and post-closure care; Part 808 includes information on special waste classifications*].

(18) Water Pollution Control Board (Title 35), Subtitle C - Part 302: Water Quality Standards [*provisions and water quality standards for general use, public and food processing water supply, secondary contact and indigenous aquatic life and Lake Michigan. Procedures for determining Water Quality Criteria are also in this Part*].

(19) Water Pollution Control Board (Title 35), Subtitle C - Part 304: Effluent Standards [*general and temporary effluent standards including NPDES effluent standards*].

(20) Public Water Supplies - Pollution Control Board (Title 35), Subtitle F - Part 611: Primary Drinking Water Standards [*includes provisions of the primary drinking*

water standards as well as maximum contaminant levels (MCLs)/goals, and analytical requirements].

(21) Public Water Supplies - Pollution Control Board (Title 35), Subtitle F - Part 620: Groundwater Quality [*includes Illinois groundwater quality standards as well as definition of groundwater class designations*].

Location-Specific Requirements

Federal

(22) Clean Water Act, (33 USC 1251, et seq.), Permits for Dredge or Fill Material (Section 404) [*Requires that no activity that adversely affects a wetlands shall be permitted if a practicable alternative that has less effect is available].*

(23) Fish and Wildlife Coordination Act (16 USC 661, et seq.) [*Requires that any federal agency that proposes to modify a body of water must consult U.S. Fish and Wildlife Services].*

(24) National Environmental Policy Act (42 USC 4321) Executive Order 11990, Protection of Wetlands [*Requires federal agencies to minimize the destruction, loss, or degradation of Wetlands and preserve].*

(25) National Environmental Policy Act (42 USC 4321) Executive Order 11988, Floodplain Management [*Requires federal agencies to reduce the risk of flood loss, to minimize impact of floods, and to restore and preserve the natural and beneficial value of flood plains].*

(26) National Environmental Policy Act (42 USC 4321) Statement of Procedures on Floodplain Management and Wetland Protection (40 CFR 6) Appendix A to Part 6 [*Promulgates Executive Orders 11988 and 11990 regarding wetlands and flood plains].*

(27) Flood Control Act (IC 14-28-1), [*Requires formal approval for any construction, excavation or filling in the floodway outside of the Superfund boundary*].

(28) Water Resources Management Act (IC-14-25-7) [*Requires registration of any significant water withdrawal facility with the Department of Natural Resources. A significant water withdrawal facility is defined as any water withdrawal facility that, in the aggregate from all sources and by all methods, has the capacity to withdraw more than 100,000 gallons of groundwater or surface water or a combination of the two in one day. This would also include any potable pumps employed by the facility*].

State

(29) Air - Pollution Control Board (Title 35), Subtitle B - Subchapter A, Part 201, Subpart D: Permit Application and Review Process [*Describes contents of the application for construction and operating permits and the review process*].

(30) Air - Pollution Control Board (Title 35), Subtitle B - Subchapter C Emission Standards and Limitations for Stationary Sources, Part 218: Organic Material Emission Standards and Limitations for the Chicago Area; Part 219: Organic Material Emission Standards for the Metro East Area [*Distinguishes emission standards for the Chicago Area and the Metro East Area - see detailed regulation for applicability to the S.E. Rockford site*].

(31) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter B: Permits, Part 703: RCRA Permit Program [*Rules on application for and issuance of RCRA permits; applicability and information requirements*].

(32) Water Pollution Control Board (Title 35), Subtitle C - Part 303: Water Use Designations and Site Specific Water Quality Standards [*provisions and site specific water quality standards for water bodies throughout Illinois*].

(33) Water Pollution Control Board (Title 35), Subtitle C - Part 309: Permits [*Subpart A includes provisions for NPDES permits and Subpart B includes provisions for all other water related permitting*]

Action-specific Requirements

Federal

(34) Clean Air Act, (42 USC 740 et seq.), National Primary and Secondary Ambient Air Quality Standards (40 CFR 50) [*Specifies maximum primary and secondary 24-hour concentrations for particulate matter*].

(35) Clean Water Act, (33 USC 1251, et seq.), Permits for Dredge or Fill Material (Section 404) [*Provides requirements for discharges of dredged or fill material. Under this requirement, no activity that affects a wetland shall be permitted if a practicable alternative that has less impact on the wetland is available. If there is no other practicable alternative impacts must be mitigated. A Section 401 water quality certification may be required from Illinois EPA if wetlands or other waters of the state are impacted*].

(36) Department of Transportation Rules for Transportation of Hazardous Materials, (49 CFR Parts 107, 171.1 - 171.5) [*Outlines procedures for the packaging, labeling, and transporting of hazardous materials*].

(37) Noise Control Act, as amended (42 USC 4901, et seq.); Noise Pollution and Abatement Act (40 USC 7641, et seq.), Noise Emission Standards for Construction Equipment (40 CFR 204) *[The public must be protected from noise that jeopardize health and welfare].*

(38) Protection of Archeological Resources (32 CFR Part 229, 229.4; 43 CFR Parts 107, 171.1 - 171.5) *[Develops procedures for the protection of archeological resources].*

(39) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Guideline for the Land Disposal of Solid Wastes (40 CFR 241), Part B - Requirements and Recommended Procedures *[Solid, nonhazardous wastes generated as a result of remediation must be managed in accordance with federal and state regulations; this is applicable to waste generated by the remedial action].*

(40) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Standards for Hazardous Waste Generators (40 CFR 262) and Standards for Hazardous Waste Transporters (40 CFR 263); *[General requirements for packaging, labeling, marking, and manifesting hazardous wastes for temporary storage and transportation offsite].* Any residues determined to be RCRA hazardous waste destined for offsite disposal are subject to manifest requirements. Remedial actions involving offsite disposal of RCRA listed wastes will be subject to this requirement.

(41) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Interim Status Standards for Owners and Operators of Hazardous Waste Treatment Storage and Disposal Facilities (40 CFR 265), Storage, and Disposal General Facility Standards, Subpart G, Closure and Post-closure. *[Sets general requirements for closure of interim status hazardous waste management units].*

(42) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Land Disposal Restriction-RCRA (40 CFR 268) *[RCRA Land Disposal Restriction, defines hazardous waste debris. This requirement is applicable to those RCRA hazardous wastes that will be disposed offsite].*

(43) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Technical Standards and Corrective Action Requirements for Owners and Operators of Underground Storage Tanks (40 CFR 280), Subpart G, Out-of-Service UST Systems and Closure, *[Sets requirements for temporary and permanent UST closure, and assessing the site closure].*

(44) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities (40 CFR 264), Subpart B, General Facility Standards; Subpart C, Preparedness and Prevention; Subpart D, Contingency Plan and Emergency

Procedures; Subpart E, Manifest System, Record Keeping and Reporting *[Establishes general requirements for storage and treatment facility location, design and inspection, waste compatibility determination, emergency contingency plans, preparedness plans, and worker training].*

(45) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities (40 CFR 264) Subpart F, Releases from Solid Waste Management Units *[Details requirements for a groundwater monitoring program to be installed at the site].*

(46) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities (40 CFR 264) Subpart G, Closure and Post-Closure *[Defines specific requirements for closure and post-closure of hazardous waste facilities].*

(47) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities (40 CFR 264), Subpart I, Use and Management of Containers; Subpart J, Tank Systems; Subpart K, Surface Impoundments; Subpart L, Waste Piles; and Subpart N, Landfills. *[Containers, surface impoundments, and landfills used to store hazardous waste must be closed and in good condition. Tank systems must be adequately designed and have sufficient structural strength and compatibility with the wastes to be stored or treated to ensure that it will not collapse, rupture, or fail, including secondary containment. Waste piles must be designed to prevent migration of wastes out of the pile into adjacent subsurface soil or groundwater or surface water at any time during its active life. Disposal of special wastes in landfills must be done in accordance with requirements].*

(48) Solid Waste Disposal Act, as amended (42 USC 6901, et seq.), Standards for Owners and Operators of Hazardous Waste Treatment Storage, and Disposal Facilities (40 CFR 264), Subpart DD, Containment Building. *[Hazardous waste and debris may be placed in units known as containment buildings for the purpose of interim storage or treatment].*

The following is a list of potential ARARs for Superfund sites that discharge treated groundwater to Publicly Owned Treatment Works (POTW):

(49) Clean Water Act, (33 USC 1251, et seq.), National Pollutant Discharge Elimination System (NPDES) Permit Regulations [40 CFR part 122.42(b)] *[Requires notification of issuing authority of re-evaluation of POTW pretreatment standards. In the event that the POTW does not have a local limitation for a particular pollutant found in the leachate from a Superfund site, it must re-evaluate*

its local limitations, and develop a limitation if necessary to protect the POTW from interference, pass-through, or contamination of the sewage sludge].

(50) Clean Water Act, (33 USC 1251, et seq.), National Pretreatment Standards (40 CFR Part 403.5) *[Discharge to a POTW must not interfere, pass through untreated into the receiving waters, or contaminate sludge].*

(51) Clean Water Act, (33 USC 1251, et seq.), National Pretreatment Program Requirements for POTWs [40 CFR Part 403.8(f)].

The following is a list of potential ARARs for Superfund sites that discharge treated groundwater to surface water bodies:

(52) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations (40 CFR Part 122.21) *[Permit application must include a detailed description of the proposed action including a listing of all required environmental permits].*

(53) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations (40 CFR Part 122.44) *(Established limitations, standards, and other NPDES permit conditions including federally approved State water quality standards].*

(54) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations [40 CFR Part 122.44(a)] *[Best Available Technology (BAT) for toxic and non-conventional wastewater or Best Conventional Technology (BCT) for conventional pollutants].*

(55) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations [40 CFR Part 122.44(b)] *[Effluent Limitations and Standards requirements under Section 301, 302, 303, 307, 318, and 405 of the Clean Water Act (CWA)].*

(56) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations, Water Quality Standards and State Requirements [40 CFR Part 122.44(d)] [Water Quality Based Effluent Limitations (WQBELs), any requirements in addition to or more stringent than promulgated effluent limitations and guidelines or standards under Section 301, 304, 306, 307, 318, and 405 of the CWA].

(57) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations, Technology Based Controls for Toxic Pollutants [40 CFR Part 122.44(e)] *[Discharge limits established under paragraphs (a), (b), or (d) of 40 CFR Part 122.44 must be established for toxins to be discharged at concentrations exceeding levels achievable by the technology-based (BAT/BCT) standards].*

(58) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations [40 CFR Part 122.44(I)] *[Requires monitoring of discharges to ensure compliance].*

(59) Clean Water Act, (33 USC 1251, et seq.), NPDES Permit Regulations [40 CFR Part 125.100)] *[The site operator must include a detailed description of the proposed action including a listing of all required environmental permits]*.

(60) Clean Water Act, (33 USC 1251, et seq.), (40 CFR Part 131) *[States are granted enforcement jurisdiction over direct discharges and may adopt reasonable standards to protect or enhance the uses and qualities of State surface water bodies]*.

(61) Clean Water Act, (33 USC 1251, et seq.), (40 CFR Parts 136.1 - 136.4)*[Requires adherence to sample preservation procedures including container materials and sample holding times]*.

(62) Fish and Wildlife Coordination Act, (16 USC 661, et seq.), *[Requires that any federal agency that proposes to modify a body of water must consult the U.S. Fish and Wildlife Services]*.

<u>State</u>

(63) Air - Pollution Control Board (Title 35), Subtitle B - Subchapter C Emission Standards and Limitations for Stationary Sources, Part 211: Definitions and General Provisions [*defines emission sources and related items*]; Part 112 Visible and Particulate Matter Emissions [*Sets emission limitations for particulate matter for a variety of operations, i.e., incinerators or waste storage piles]*. Also see Parts 214-219 which gives information regarding specific types of emissions per operation (e.g., sulfur, organic material, carbon monoxide and nitrogen oxide emissions). *[These regulations may apply to some of the presumptive remedies in which emissions will be a factor - e.g., incineration]*.

(64) Air – Pollution Control Board (Title 55), Subtitle B – Permits of Air Pollution, Part 201: Prohibition of Air Pollution *[No person shall cause or threaten or allow the discharge or emission of any contaminant into the environment]*.

(65) Air – Pollution Control Board (Title 35), Subtitle B – Air Pollution, Part 212; Visual and Particulate Matter Emission *[Emission standards for incinerators]*.

(66) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter B: Permits, Part 703: RCRA Permit Program [*Rules on application for and issuance of RCRA permits; applicability and information requirements*].

(67) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, Parts 722 and 723 [***includes standards applicable to generators and transporters of hazardous waste, respectively***].

(68) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, Parts 724 and 725 [*includes*

standards applicable to owners and operators of hazardous waste treatment, storage and disposal facilities (Part 735 is for Interim Status) - corresponds to 40 CFR 264 and 265].

(69) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, Part 726 [*includes standards for the management of specific hazardous waste and specific types of hazardous waste management facilities; often applies to hazardous waste being used in such a way as to constitute disposal*].

(70) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, Part 728: Land Disposal Restrictions [*defines land disposal restrictions for wastes, waste specific prohibitions, treatment standards, and prohibitions on storage*].

(71) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter C: Hazardous Waste Operating Requirements, Part 729: Prohibited Hazardous Wastes in Land Disposal Units [*describes general hazardous waste restrictions and restrictions on halogenated solvents and liquid hazardous wastes in landfills*].

(72) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter D: Underground Injection Control and Underground Tank Storage Program, Part 731: Underground Storage Tanks [*regulations regarding USTs*].

(73) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter D: Underground Injection Control and Underground Tank Storage Program, Part 740: Site Remediation Program [*Procedures established for investigation and remediation at sites where there is a release, or suspected release of hazardous substances, pesticides, or petroleum for review and approval of these activities*].

(74) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter D: Underground Injection Control and Underground Tank Storage Program, Part 742: Tiered Approach to Corrective Action Objectives [*Procedures for evaluating the risk to human health posed by environmental conditions and develop remediation objectives that achieve acceptable risk level. Also, to provide for adequate protection of human health and the environment based on risks to human health posed by environmental conditions while incorporating site related information*].

(75) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter H: Illinois "Superfund" Program, Part 750: Illinois Hazardous Substances Pollution Contingency Plan [*regulation which is applicable whenever there is a release or a threat of a release at a site; this part assigns responsibility, organization and guidelines for phased hazardous substance response including development of*

remedial alternatives and engineering methods for on-site actions and remedying releases].

(76) Waste Disposal - Pollution Control Board (Title 35), Subtitle G - Subchapter I: Solid Waste and Special Waste Hauling [*Part 807 includes information on solid waste permitting, sanitary landfills and closure and post-closure care; Part 808 includes information on special waste classifications*].

(77) Water Pollution Control Board (Title 35), Subtitle C - Part 304: Effluent Standards [*general and temporary effluent standards including NPDES effluent standards*].

(78) Water Pollution Control Board (Title 35), Subtitle C - Part 309: Permits [*Subpart A includes provisions for NPDES permits and Subpart B includes provisions for all other water related permitting*]

(79) Public Water Supplies - Pollution Control Board (Title 35), Subtitle F - Part 620: Groundwater Quality [*Prescribes various aspects of groundwater quality including methods of classification of groundwaters, non-degradation provisions, standards for quality of groundwaters and various procedures and protocols for the management and protection of groundwaters*].

Other Requirements to be Considered (TBCs)

Federal

(80) Geological Survey Professional Paper 579-0, Elemental Composition of Surficial Materials in the Conterminous United States, 1971. Schacklette, H.T., J.C. Hamilton, J.G. Boerrgen and J.M. Bowles [*Provides background levels of metal in soils for the United States*].

(81) Illinois EPA Tiered Approach to Corrective Action Objectives (TACO) 35 ILL.ADM Code Part 742, July 1998. [*Specifies methods for developing remediation objectives and identifying chemicals of concern for sites in Illinois*].

(82) Occupational Safety and Health Administration Standards (29 CFR 1910; 1910.1000), Subpart Z, Toxic and Hazardous Substances *[Sets worker exposure limits to toxic and hazardous substances and prescribes the methods for determination of concentrations]*.

(83) Occupational Safety and Health Administration Standards (29 CFR 1910; 1910.95), Subpart G, Occupational Noise Exposure. *[Sets limits of worker exposure to noise during the performance of their duties]*.

(84) Occupational Safety and Health Administration Standards (29 CFR 1910; 1910.120), Hazardous Waste Operations and Emergency Response *[Sets the standards for workers conducting hazardous waste operations and emergency response]*.

(85) Occupational Safety and Health Administration Standards (29 CFR Part 1926) *[Specifies the type of safety equipment and procedures to be followed during site remediation]*.

(86) Occupational Safety and Health Administration Standards Record keeping, Reporting and Related Regulations (29 CFR 1904) *[Establishes Record keeping and reporting requirements for an employer under OSHA]*.

(87) OSWER Directive 9355.0-48FS - Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with Volatile Organic Compounds in Soil, September 1993 [*addresses the vadose zone only*].

(88) OSWER Directive 9355.3-01, October 1988 Interim Final - Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA Development and Screening of Remedial Alternatives [*development of the FS Work Plan*].

(89) OSWER Directive 9355.4-01-Guidance on Remedial Actions for Superfund Sites with PCB Contamination *[Sets soil PCB clean-up levels and management controls for PCB concentrations at Superfund sites]*.

(90) OSWER Directive 9355.4-12 - Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Sites and RCRA Corrective Action Facilities. [*Sets soil lead clean-up levels for Superfund sites*].

(91) Safe Drinking Water Act (42 USC 300f, et seq.), Subpart F, Maximum Containment Level Goals (40 CFR 141.50 - 141. 51) *[Establishes unenforceable clean-up goals for drinking water based on technology and health risk]*.

(92) Threshold Limit Values *[Consensus standards for controlling air quality in work place environments; used to assess site inhalation risks for soil removal operations]*.

(93) U.S. Environmental Protection Agency, RCRA Guidance Manual for Subpart G Closure and Post-Closure Standards and Subpart H Cost Estimating Requirements, January 1987. [*Provides guidance on closure and post-closure standards and cost estimating requirements for hazardous waste management units*].

(94) U.S. Environmental Protection Agency, Disposal of Polychlorinated Biphenyls, Proposed Rule, December 6, 1994. [*Provides for disposal of non-liquid PCB*

remediation waste generated by clean-up process of their existing concentration; provides for a risk-based remediation option for PCB remediation waste].

(95) U.S. Environmental Protection Agency, Soil Screening Guidance, December 1994 [*Provides generic risk-based soil screening values for Superfund sites*].

(96) U.S. Environmental Protection Agency Region III, Risk - Based Concentration Table, Smith R., 1995. [*Provides risk-based screening values for groundwater and soil concentrations*].

(97) U.S. Environmental Protection Agency, Integrated Risk Information System (IRIS), 1995 - 1996. [*Provides reference doses and cancer potency slopes for calculating the hazard index or incremental cancer risk for specific site contaminants*].

(98) U.S. Environmental Protection Agency, Interim Policy for Planning and Implementing CERCLA Off-Site Response Actions, November 5, 1995. [*Specifies appropriate method of off-site treatment on disposed of waste from a Superfund site*].

(99) U.S. Environmental Protection Agency, Summary Quality Criteria for Water, Office of Science and Technology, 1992. [*Provides ambient water quality criteria*].

(100) U.S. Environmental Protection Agency, Quality Criteria for Water, Office of Water Regulation and Standards, U.S. EPA 440/5-86-001, 1986. [*Provides ambient water quality criteria*].

(101) U.S. Environmental Protection Agency, Ambient Water Quality Criteria for Polychlorinated Biphenyls, U.S. EPA 440/5-80-068, 1980. [*Provides ambient water quality criteria for PCBs*].

(102) U.S. Environmental Protection Agency, Risk Assessment Guidance for Superfund: Environmental Evaluation Manual, Volume II, Final Report, EPA/540/1-89/002, 1989. [*Provides guidance for conducting ecological risk assessments*].

(103) U.S. Environmental Protection Agency, Risk Assessment Guidance for Superfund. Volume I. Human Health Evaluation Manual Supplemental Guidance. Standard Default Exposure Factors, Interim Final, March, 1991. OSWER Directive #9285.6-03, 1991. [*Provides exposure factors for estimating hazard or risk in human health risk assessments*].

(104) U.S. Environmental Protection Agency, Risk Assessment Guidance for Superfund. Volume I: Human Health Evaluation Manual, Part A, December, 1989. U.S. EPA 540/1-89/002. Office of Emergency and Remedial Response. [*Provides guidance on preparing a baseline human health risk assessment using the*

four steps, data evaluation, exposure assessment, toxicity assessment, risk characterization].

3.4 Remediation Goals

The risk assessment followed a tiered approach, in conformance with Tiered Approach to Corrective Action Objectives (TACO): 35 IAC 742 (It is noted that TACO is considered a TBC). TACO specifies a three-tiered approach, and any, or all three tiers can be used. Tier 1 involves a comparison of site data to pre-established Soil Remediation Objectives protective of three exposure pathways: (1) incidental ingestion of soil; (2) inhalation of chemicals that could volatilize from soil to ambient air; and (3) the soil component of the groundwater ingestion exposure route, i.e., leaching from soil to groundwater that could be used for drinking water. The first two pathways will be referred to as the "direct contact" pathway. Tier 2 involves developing site-specific objectives using risk algorithms and fate and transport models presented in the TACO regulations. Tier 3 involves using alternative models to those presented in the TACO regulations. A combination of Tiers 1 and 3 was used to evaluate risks at the site. Tier 1 evaluation was conducted for the direct contact with soil and the soil component of the groundwater pathway. A Tier 3 evaluation was used to further evaluate chemicals, which exceeded the Tier 1 values for the migration from soil to groundwater pathway and to evaluate the vegetable ingestion pathway (Area 7 only).

Sampling data collected from surface and subsurface soil from each of the four source areas were compared to the Tier 1 Exposure Route-Specific Values (ingestion and inhalation) for soil protective of residential areas and the Soil Component of the Groundwater Ingestion Exposure Route Values for Class I groundwater. The Exposure Route-Specific Values (ingestion and inhalation) are protective of direct contact with soil, while the Soil Component of the Groundwater Ingestion Exposure Route Values are protective of groundwater impacted by contaminants that could leach from soil.

As directed by Illinois EPA, it was assumed that all four source areas were, or could become, residential areas. Currently, no land use restrictions are in place to prevent residential development or expansion, therefore, it was necessary to employ soil remedial objectives that would be protective of residential land use. Because the exposure assumptions for the residential scenario are fairly standardized, with few site-specific modifications, there was no advantage to developing Tier 2 values for the residential scenario.

While a city ordinance is in place prohibiting the construction of new wells, private wells still exist within Southeast Rockford. For this reason, it is a long-term goal that groundwater, beyond the active GMZ in each area, will be protected to drinking water standards. Within the GMZ, active remediation will be taking place. The edge of the GMZ will be the point of compliance for groundwater. Because several chemicals exceeded Tier 1 values for soil that could impact groundwater, Tier 3 soil remediation goals were developed. Soil goals were developed to be protective of groundwater at the edge of the GMZ.

3.4.1 Tier 1 Assessment

Tier 1 Assessment - Initial Screening (Phase 1)

Tier I - Phase I evaluates both the direct contact pathway and soil to groundwater ingestion pathway. The first phase of the Tier 1 assessment involved the following steps:

1. Compile sampling and analysis data collected during the Phase I and SCOU sampling events.

2. Segregate data into surface (0-3 feet) and subsurface (>3 feet) soil samples. Segregate subsurface data further into data sets representing soil between three and ten feet and below ten feet.

3. Summarize sampling and analysis data (range of detected concentrations, frequency of detection).

4. Compare maximum concentrations to Tier 1 standards and identify exceedances of Exposure Route-Specific Values or Soil Component of the Groundwater Ingestion Exposure Route Values.

5. Compare chemicals to background concentrations reported in TACO and site-specific background.

Tables 3-2 through 3-4 identify the chemicals that exceed either an Exposure Route-Specific Value or Soil Component of the Groundwater Ingestion Exposure Route Value and whether the chemical was carried to the next phase of the assessment as a chemical of concern. Chemicals that exceeded a standard were excluded from further evaluation using the following criteria:

1. Maximum concentrations below TACO or site-specific background;

2. Inorganics detected at concentrations found not to be significantly different than site-specific background concentrations;

3. For the soil to groundwater route only - chemicals detected at low frequency of detection in soil or not detected in groundwater; and

Table 3-2
Tier 1 Exceedances and Selection of Chemicals of Concern for Surface Soil
Southeast Rockford - Source Control Operable Unit
Focused Feasibility Study

AREA	Exceedance			Selected Chemicals of Concern		Reason for Exclusion	
	Direct Contact	Soil to GW	Background	Direct Contact	Soil to GW	Direct Contact	Soil to GW
Area 4 (Residential)							
Carbazole		X			no		Not GW Contaminant
Benzo (a) anthracene	X	X	X	yes	no		Not GW Contaminant
Benzo (b) Fluoranthene	X	X	X	yes	no		Not GW Contaminant
Benzo (k) Fluoranthene	X		X	yes			
Benzo (a) Pyrene	X		X	yes			
Dibenzo (a,h) Anthracene	X		X	no		Below PQL	
Arsenic	X			no		Below Background	
Beryllium	X			no		Below Background	
Area 7 (Residential)							
Methylene Chloride		X			yes		
Tetrachloroethene		X			yes		
Benzo (a) Pyrene	X			no		Below Background and PQL	
Dieldrin		X			no		Not GW Contaminant
Arsenic	X			no		Below Background	
Beryllium	X			no		Below Background	
Area 9/10 (Residential)							
Benzo (a) anthracene	X	X		yes	no		Not GW Contaminant
Benzo (a) Pyrene	X			yes			
Benzo (b) Fluoranthene	X			yes			
Indeno (1,2,3,-cd) Pyrene	X			yes			
Dieldrin	X	X		yes	no		Not GW Contaminant
Arsenic	X			no		Below Background	
Beryllium	X			no		Below Background	
Area 11 (Residential)							
Carbazole	X	X		yes	no		Not GW Contaminant
Benzo (a) anthracene	X	X		yes	no		Not GW Contaminant
Chrysene	X	X		yes	no		Not GW Contaminant
Benzo (b) Fluoranthene	X	X		yes	no		Not GW Contaminant
Benzo (k) Fluoranthene	X	X		yes	no		Not GW Contaminant
Benzo (a) Pyrene	X	X		yes	no		Not GW Contaminant
Indeno (1,2,3-cd) Pyrene	X	X		yes	no		Not GW Contaminant
Dieldrin		X			no		Not GW Contaminant
Arsenic	X			no		Below Background	
Beryllium	X			no		Below Background	

Table 3-3
Tier 1 Exceedances and Selection of Chemicals of Concern for Subsurface Soil: Above 10 Feet
Southeast Rockford - Source Control Operable Unit
Focused Feasibility Study

AREA	Exceedance		Selected Chemicals of Concern		Reason for Exclusion	
	Direct Contact	Soil to GW	Direct Contact	Soil to GW	Direct Contact	Soil to GW
Area 7 (Residential)						
1,2-Dichloroethene		X		yes		
1,1,1-Trichloroethane		X		yes		
Trichloroethene	X	X	yes	yes		
Tetrachloroethene	X	X	yes	yes		
Toluene		X		yes		
Ethylbenzene		X		yes		
Xylene		X		yes		
2,4-Dinitrotoluene	X	X	no	no	(1)	(1)

Notes:
(1) More data needed to verify whether chemical of concern. To be addressed in Section 4.

Table 3-4
Tier 1 Exceedances and Selection of Chemicals of Concern for Subsurface Soil: Below 10 Feet
Southeast Rockford - Source Control Operable Unit
Focused Feasibility Study

AREA	Exceedance		Selected Chemicals of Concern		Reason for Exclusion	
	Direct Contact	Soil to GW	Direct Contact	Soil to GW	Direct Contact	Soil to GW
Area 4 (Residential)						
1,1,1 - Trichloroethane		X		yes		
Area 7 (Residential)						
1,2-Dichloroethene (total)		X		yes		
Chloroform		X		no		(1)
1,2-Dichloroethane		X		yes		
1,1,1-Trichloroethane		X		yes		
Trichloroethene		X		yes		
Benzene		X		no		(1)
Tetrachloroethene		X		yes		
Toluene		X		yes		
Chlorobenzene		X		no		(1)
Ethylbenzene		X		yes		
Area 9/10 (Residential)						
Methylene Chloride		X		yes		
Area 11 (Residential)						
Methylene Chloride		X		yes		
Trichloroethene		X		yes		
Benzene		X		yes		
Toluene		X		yes		
Ethylbenzene		X		yes		
Xylene		X		yes		
2-Methylphenol		X		yes		

Notes:
(1) Frequency of detection <5%, not detected in groundwater.

4. Maximum concentrations below the PQL.

Chemicals that exceeded a Tier 1 standard and background (if available) were carried to the next phase of the assessment. For chemicals that exceeded an Exposure Route-Specific Value, the next phase involved calculating a 95% UCL for comparison to the Tier 1 value. For chemicals that exceeded a Soil Component of the Groundwater

Ingestion Exposure Route Value, the next phase involved a Tier 3 assessment and calculation of site-specific remediation goals.

Tier 1 - Phase 2

For chemicals that exceeded an Exposure Route-Specific Values and background concentrations (if available), the second phase of the evaluation for the direct contact pathway involved the following steps:

1. Calculate the 95% upper confidence limits (UCL) on the mean concentrations for chemicals that exceeded site-specific background and PQL.

2. Compare 95% UCLs to the higher of the Tier 1 concentrations or the practical quantitation limit (PQL) reported in SW-846. (Test Methods for Evaluating Solid Waste, Final Update, U.S. EPA, December 1996).

A procedure was developed for calculating the 95% UCL to accommodate conditions encountered among the data sets for the four different areas. Many of the detected concentrations were estimated values below the detection limits, ("J" values). This resulted in a large range of detected concentrations in areas that also had hot spots. For the purpose of the RA, the term "hot spot" is defined as a specific location within one of the far areas of concern that contains concentrations which are two orders of magnitude above the lowest detected concentration. Within that areas, the standard deviations for the data were large and resulted in 95% UCL values which exceeded maximum concentrations. For these areas, hot spots were removed from the data sets and were recalculated . Hot Spots were later addressed in the FS as areas of concern.

A minimum of 5 samples were needed to calculate the 95% UCL. Chemicals with fewer than 5 samples were evaluated on a case by case basis. A minimum of 50% detections was needed to calculate the 95% UCL on the mean. If there were less than 50% detections, the 95% UCL on the median was calculated, as approved by Illinois EPA. In the event that a calculated, or recalculated (after removing hot spots) UCL exceeded a maximum concentration, the maximum concentration was used as the representative concentration for comparison to the higher of the Tier 1 value or the PQL. **Table 3-5** presents the results of the 95% UCL evaluation. In areas 4 and 11, hot spots, where concentrations were two orders of magnitude greater than the lowest detected concentrations, were identified. These samples were removed from the dataset and the 95% UCL was re-calculated. Following the removal of hot spots from

Table 3-5
Results of the Tier 1 (Phase 2) 95% UCL Calculations for SVOCs
Southeast Rockford - Source Control Operable Unit
Focused Feasibility Study

Area 4	
Surface	3 hot spot samples (SS4-201, SS4-203, SS4-203D) addressed in FS All other hits below PQL or Tier 1 values
Subsurface (<10 ft)	No SVOC exceedances(1)
Subsurface (>10 ft)	No SVOC exceedances(1)
Area 7	
Surface	No SVOC exceedances(1)
Subsurface (<10 ft)	No SVOC exceedances(1)
Subsurface (>10 ft)	No SVOC exceedances(1)
Area 9/10	
Surface	3 out of 4 samples with exceedances (SS910-101, SS910-103, SS910-104) addressed in FS
Subsurface (<10 ft)	No samples
Subsurface (>10 ft)	No SVOC exceedances(1)
Area 11	
Surface	2 hot spots (SS11-206, SS11-207) addressed in FS
Subsurface (<10 ft)	No samples
Subsurface (>10 ft)	No SVOC exceedances(1)

(1) maximum concentrations of SVOCs did not exceed Tier 1 values and/or background concentrations, therefore, 95%UCLs not calculated.

the data sets, all remaining concentrations were below the Tier 1 value or the PQL. In area 9, only four SVOC samples were available, not enough to calculate a 95% UCL. SVOC in three of the four samples exceeded the higher of the Tier 1 value and the PQL. This information was used in the FS to determine the need for further sampling or remediation.

Results of Tier 1 Assessment

The results of the assessment of the direct contact pathway can be summarized as follows:

1. Maximum concentrations of VOCs did not exceed their respective Exposure Route Specific Values in Areas, 4, 9/10, and 11 and were dropped from further evaluation for the direct contact pathway. In Area 7, Trichloroethene and Tetrachloroethylene exceed their respective Exposure Route Specific Values in two locations.

2. Maximum concentrations of SVOC and inorganics exceeded their respective Exposure Route-Specific Values in all four areas.

3. Maximum concentrations of inorganics and one SVOC in area 7, benzo (a) pyrene, were dropped from further evaluation because detected concentrations were less than or consistent with background concentrations. Risk associated with these chemicals are below 1E-06 (one in one million) and/or a hazard index of 1.0.

4. Selected samples in Areas 4 (SS4-201, SS4-203, SS4-203D) and 11 (SS11-206, SS11-207) were identified as hot spots that exceeded Tier 1 values and PQLs for SVOCs. Three out of four samples in Area 9/10 (SS910-101, SS910-103, SS910-104) exceeded one or more PNA values. These data are presented in Appendix B. The hot spots in Areas 4 and 11 and the samples exceeding a PNA value in Area 9/10 will be addressed in the FFS. Additional data may be needed in the remedial design phase to better characterize risk and the extent of contamination. Based on the results of sampling, if necessary, remedial alternatives that address SVOCs would be developed and evaluated. The presence of these hot spots represents a potential exceedance of risk limits established by U.S. EPA (a noncancer hazard index of 1.0 and cancer risks of between one in one million and one in one hundred thousand) and Illinois EPA (a noncancer index of 1.0 and cancer risks of one in one million used to develop the Tier 1 values) depending on actual exposure.

The results of the assessment of the soil to groundwater pathway can be summarized as follows:

1. Several chemicals were dropped from further evaluation for the soil to groundwater pathway because they were not detected in groundwater (Dieldrin, carbazole and several SVCOs).

2. VOCs in surface soil in area 4 and VOCs in subsurface soil in all four areas exceeded Tier 1 SCGV values. These VOCs were further evaluated in Tier 3.

3.4.2 Tier 3 Assessment

A Tier 3 assessment was conducted for those chemicals that exceeded a Soil Component of the Groundwater Ingestion Exposure Route Value and were detected in groundwater during past sampling events at greater than 5 percent frequency of detection. The Tier 3 assessment consisted of calculating soil concentrations protective of groundwater at a designated point of compliance. The point of compliance is the boundary of the GMZ established in each of the four areas. The GMZ is the area within which active remediation is underway.

TACO presents two models for calculating site-specific remediation objectives for the soil to groundwater pathway - the Soil Screening Level (SSL) Model and the Risk-Based Corrective Action (RBCA) Model. Only the RBCA model incorporates a component to address the dilution and attenuation that occurs in a GMZ, therefore, this was the model employed to calculate the Tier 3 concentrations.

The RBCA model incorporates site-specific information on the following variables:

- fraction of organic carbon (FOC)
- infiltration rate of water through soil
- hydraulic gradient
- hydraulic conductivity
- width of the source areas parallel to groundwater flow
- width of the source areas perpendicular to groundwater flow in the horizontal and vertical planes
- groundwater mixing zone thickness
- distance to boundary of groundwater management zone

The values used for these variables, as well as other default values used in the RBCA model, are presented in Appendix A. Equations R12 through R26, presented in Appendix C, Table C of TACO were used to calculate the Tier 3 concentrations. All of the variables used in these equations are defined in Table A-1 in Appendix A. Other key variables, including leaching factors, diffusion coefficients, saturation concentrations, and attenuation factors, are calculated and presented on Tables A-2 through A-5. The Tier 3 risk-based soil levels protective of groundwater are presented on **Table 3-6** for the chemicals of concern. Tier 1 concentrations are also presented for comparative purposes. Except for one chemical (trichlorethene) in Area 11, all Tier 3 concentrations were greater than the Tier 3 concentrations. The saturation concentrations are also presented, and, according to TACO, the ultimate remediation objective is the lower of the calculated concentration and the saturated concentration, diffusion coefficients, saturation concentrations, and attenuation factors, are calculated and presented on Tables A-2 through A-5. The Tier 3 risk-based soil levels protective of groundwater are presented on **Table 3-6** for the chemicals of concern. Tier 1 concentrations are also presented for comparative purposes. The saturation concentrations are also presented, and, according to TACO, the ultimate remediation objective is the lower of the calculated concentration and the saturation concentration. The saturation concentration is the lower of the two concentrations for several chemicals in Areas 7, 9/10 and 11. Hot spots or source areas were identified in Area 7 and three hot spots were identified in Area 9/10, each at different distances from the edge of the GMR and with different source width and source thickness. A set of remediation objectives was calculated for each of these source areas. Areas 4 and 11 had only one hot spot. For this reason, only one set of remediation objectives was developed for areas 4 and 11.

In some cases, the calculated concentrations were absurdly high concentrations - greater than one million parts per million. This is due to the high first order degradation rates for chemicals such as methylene chloride and toluene. These chemicals would degrade before ever reaching the edge of the GMZ. The numerical model back calculates the value associated with the groundwater objective at the GMZ. In the case of chemicals that rapidly degrade, the calculated value in soil is higher than the maximum of one million parts per million. In these cases, the saturation concentration is the default remediation objective.

Results of Tier 3 Assessment

The results of the assessment of the soil component of the groundwater ingestion pathway can be summarized as follows:

1. In Area, 4, 1,1,1-trichloroethane exceeded its soil remediation objective. In Area 7, cis-1,2-dichloroethene, 24-dinitrotoluene, tetrachlorene, 1,1,1-trichlorethane, trichlorethene, and total xylenes exceeded either their respective soil remediation objective or the soil saturation limit. In Area 11, benzene, ethylbenzene, toluene, trichloroethene, and total xylenes exceeded

Table 3-6
Risk-Based Soil Levels Protective of Groundwater for Each Area
Southeast Rockford Operable Unit

Comparison of Calculated Tier 3 Soil Remediation Objectives to Tier I (mg/kg)

Area 4	$RBSLatten_{area4}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
1,1,1-Trichloroethane	9.118	1084	2	510

Area 7	$RBSLatten_{area7p}$	$RBSLatten_{area7d}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
1,2-Dichloroethane	3.678	1787.000	1768	0.02	0.18
cis-1,2-Dichloroethene	0.941	11.500	1141	0.4	49
2,4-Dinitrotoluene	0.162	80.900	182	0.0008	1.5
Ethylbenzene	57.347	953.000	389	13	31
Methylene Chloride	1.15E+06	2.27E+12	2303	0.02	0.012
Tetrachloroethene	1.465	136	218	0.06	260
Toluene	337502367.730	3.74E+14	638	12	23
1,1,1-Trichloroethane	108.033	19622.000	1084	2	460
1,1,2-Trichloroethane	0.619	56.300	1784	0.02	0.46
Trichloroethene	0.310	7.200	1242	0.06	130
Xylenes (total)	34105.533	1.66E+07	312	150	210

Area 9/10	$RBSLatten_{area9/10s}$	$RBSLatten_{area9/10w}$	$RBSLatten_{area9/10ns}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
Methylene Chloride	3.26E+23	2.22E+12	4.13E+21	2303	0.02	0.048

Area 11	$RBSLatten_{area11}$	C^s_{sat}	Residential Class I GW Tier I SRO	Maximum Detected Concentration
Benzene	0.189	824	0.03	1.5
Ethylbenzene	7.983	389	13	590
Methylene Chloride	4.79E+07	2303	0.02	2.9
2-Methylphenol	2.82E+23	16827	15	0.58
Toluene	1.06E+10	638	12	1400
Trichloroethene	0.051	1242	0.06	0.41
Xylenes (total)	24500.418	312	150	2,300

Notes:

RBSLatten refers to the degree of attenuation associated with a particular source area as calculated using the equation R15 of TACO. The soil remediation objective within this column takes the RBSLatten value into account. A remediation objective calculated using the RBSL is as protective as the Tier 1 value because the RBSL value considers site specific data as opposed to the statewide general data used to calculate the Tier 1 value.

C^s is the saturation concentration calculated using the equation S29 of TACO. If a chemical concentration exceeds this value, it may be present as a free product, and it is Illinois EPA policy to remediate free product if technically practicable.

SRO is the TACO Tier 1 soil remediation objective

The ultimate soil remediation objective for the protection of gorundwater is the lower of the RBSLatten concentration and the C^ssat value.

The exceptions are for ethylbenzene, trichloroethene, and total xylenes in Area 11, where the Residential Class 1 groundwater Tier 1 SRO is used instead either their soil remediation objective or soil saturation limit. Risks associated with these chemicals in each area of concern exceed cancer-risk limits of one in one million or a hazard index of 1.0.

2. All areas, where detected chemical concentrations exceeded the lower of the SRO or saturation concentration, were further evaluated in the Feasibility Study. Volumes estimates were developed for these areas for excavation or remediation purposes.

Chemical data in Illinois EPA project files indicate significantly high PCE concentrations in the former outdoor drum storage area located in the west part of the property now occupied by Sundstrand Corporation Plant #1 (2421 11th Street). These data were not included as part of this risk assessment. This area is referred to as Area $9/10_w$ in this FFS. PCE soil concentrations in Area $9/10_w$ significantly exceeded the Tier 3 cleanup objective of 43.5 mg/kg. Concentration contours indicate that between zero and five feet below ground surface, a hot spot area covering approximately 350 to 400 square feet exceeds the Tier 3 cleanup objective for PCE. The highest analyzed concentrations within the hot spot ranged from 47 to 3,500 mg/kg PCE. Contaminated soil within Area $9/10_w$ is addressed by the soil remedial alternatives in this FFS.

Vegetable Ingestion Pathway

Area 7 borders land currently used for agricultural purposes, and no current zoning restrictions prevent conversion of some of the undeveloped portions of Area 7 to agricultural use. For these reasons, a semi-quantitative evaluation was conducted to determine whether the use of Area 7 for growing vegetables or fruits would result in an unacceptable risk to human health. The use of this land for dairy farming was not considered due to the limited size of Area 7.

Based on this evaluation, it is concluded that ingestion of vegetables (or fruits which have a fresh weight consumption rate lower than vegetables, i.e., 88 mg/day) would not result in exceedance of either a hazard index of 1.0 or a cancer risk of 1E-06 (one in one million), which are the risk limits on which the Tier 1 values are based.

3.4.3 Conclusion

A combination of a Tier 1 and Tier 3 assessment was used to assess risks at the four source areas at the SCOU. Tier 1 was used to evaluate the direct contact pathway and the soil component of the groundwater ingestion pathway and Tier 3 was used to evaluate the migration from soil to groundwater pathway for those chemicals which exceed Tier 1 values and the ingestion of vegetables pathway (Area 7 only). The Tier 1 assessment resulted in the identification of two locations in Area 7 that exceeded VOC values. The Tier 1 assessment also identified SVOC hot spots in Areas 4 and 11 and individual samples in Area 9/10 that exceeded one or more SVOC values.

The Tier 3 assessment resulted in soil remediation goals for VOCs in all four areas. The Tier 3 assessment yielded concentrations that, with one exception, were higher than the Tier 1 concentrations. The Tier 3 concentrations were used to develop a remediation plan, which is discussed within the following sections of this FFS.

The results of the Tier 3 assessment concluded that ingestion of vegetables would not result in exceedance of either a hazard index of 1.0 of a cancer risk of one in a million, which are the risk limits on which the Tier 1 values are based.

Section 4 Identification of General Response Actions and Screening of Remedial Technologies

4.1 Identification of General Response Actions

In accordance with CERCLA guidance, once the remedial action objectives for a site have been established (Section 3), the next step in developing remedial alternatives is to identify general response actions that may be taken to satisfy the remedial action objectives for each medium of concern.

The selection of remedial response actions for contaminated soil at the Southeast Rockford SCOU follows a presumptive remedy approach. The "Presumptive Remedy for VOCs in Soil" guidance document does specifically apply to the Southeast Rockford SCOU. Specific presumptive remedies common to VOCs in soil include soil vapor extraction, thermal desorption, and incineration. Use of the presumptive remedy approach allows specific response actions to be considered without detailed screening of all potentially appropriate technologies. Therefore, the FFS process can be streamlined for the soil medium and focused on the most appropriate response action.

It is noted that the selection of technologies and development for remedial alternatives for leachate will follow the typical FFS process. Leachate is assumed to be contamination originating from the soil source areas that could or has migrated to the unconsolidated aquifer within the designated GMZ for each source area.

4.1.1 Media of Concern

Prior to proceeding with identification of general response actions, identification and screening of technologies, and development and analysis of alternatives, it is necessary to identify the media of concern. The media of concern have been identified as those which pose a threat to human health and/or the environment based on the characteristics of their contamination and their potential for migration and exposure as determined by the final Risk Assessment (CDM, 2000). **Table 4-1** presents the media of concern and corresponding chemicals of potential concern (COPCs) for each source area. Two media of concern consisting of soil and leachate have been identified in Source Areas 4, 7, and 9/10. Soil is the only media of concern for Source Area 11. It is noted that leachate is not a media of concern in Source Area 11. The results of fate and transport analysis (see Section 6) indicate that leachate ARARs would be attained at the GMZ boundary.

Table 4-1
Southeast Rockford SCOU
Focused Feasibility Study
Site Media and Chemicals of Potential Concern

Site Area	Contaminants of Potential Concern	
	VOCs	SVOCs/PAHs
[redacted]		
Surface soil[a]		Benzo(a) anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene
Subsurface Soil[b]	1,1,1-Trichloroethane	
Leachate	1,1-Dichloroethene 1,1,1-Trichloroethane Trichloroethene	
[redacted]		
Surface soil[a]	Methylene Chloride Tetrachloroethene	
Subsurface Soil[b]	1,2-Dichloroethene (total) 1,2-Dichloroethane 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethene Tetrachloroethene Toluene Ethylbenzene Xylenes(total)	2,4-Dinitrotoluene
Leachate	1,1-Dichloroethene cis-1,2-Dichloroethene 1,1,1-Trichloroethane Trichloroethene Tetrachloroethene	
[redacted]		
Surface soil[a]		Benzo(a)anthracene Benzo(b)fluoranthene Benzo(a)pyrene Indeno(1,2,3-cd)perylene
Subsurface Soil[b]	Methylene Chloride tetrachloroethene	
Leachate	1,1-Dichloroethene 1,1,1-Trichloroethane Tetrachloroethene	
[redacted]		
Surface soil[a]		Benzo(a) anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Chrysene
Subsurface Soil[b]	Methylene Chloride Trichloroethene Benzene	2-Methylphenol

Table 4-1
Southeast Rockford SCOU
Focused Feasibility Study
Site Media and Chemicals of Potential Concern

Site Area	Contaminants of Potential Concern	
	VOCs	SVOCs/PAHs
	Toluene Ethylbenzene Xylenes(total)	
Leachate	1,1,1-Trichloroethane Trichloroethene Benzene Toluene Ethylbenzene Xylenes(total)	

Notes:
[a] Soils at a depth less than 3 feet.
[b] Soils at a depth greater than 3 feet.
[c] Commercial / Industrial is the current scenario for this source area, however remediation goals were calculated under a residential scenario (see Section 2.2.1).

Source Area - Soil/Leachate

Both VOCs (which are the primary focus of this FFS) and semi-volatile organic compounds (SVOCs) were detected at elevated concentrations in soil and leachate samples collected from each of the four source areas. However, regarding SVOCs, the sample locations within all four source areas are located far apart. Additionally, within Areas 4, 11, and 9/10, samples with elevated concentrations of SVOCs are outside of the source areas addressed within this FFS. Within Area 7 however, although samples with elevated concentrations of SVOCs were located within the area of concern, SVOCs will not be addressed in this FFS.

The specific SVOCs detected at elevated levels within the four areas of concern were 2,4-dinitrotoluene, 2-methylphenol and the polycyclic aromatic hydrocarbon compounds (PAHs) including benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, and indeno(1,2,3-c,d)perylene. The concentrations of these compounds and the standards that they were compared to are presented in the Risk Assessment. Additional data may be needed in the remedial design phase to better characterize risk and the extent of contamination. Based on the results of sampling, if necessary, remedial alternatives that address SVOCs would be developed and evaluated.

It is noted that the Risk Assessment identified SVOCs/PAHs, tetrachloroethene and methylene chloride as COPCs for subsurface soil and 1,1-dichloroethene, 1,1,1-trichloroethane, and tetrachloroethene have been identified as COPCs for leachate in Source Area 9/10. However, only limited data exists for the source of contamination in Area 9/10. The major source(s) of contamination appear to be located on the property occupied by Sundstrand Corporation's Plant #1. Elevated levels of VOCs (greater than 18 mg/L total VOCs) were detected in the groundwater down gradient of the source in MW201. In addition, elevated levels of VOCs were detected in soil gas sampling conducted down gradient. Minor levels of contamination were found upgradient of the Sundstrand property, specifically at the former Mid-States facility. However, samples collected from upgradient monitoring wells showed only background contaminant levels.

A GMZ has been established for each source area. This zone established a three dimensional region containing groundwater being managed to mitigate contamination caused by the release of contaminants from the site. The GMZs for each source area are shown on Figures 3-1 through 3-4. This FFS will address the contaminated leachate (see **Table 4-1**) contained within the GMZ in each source area.

Site-wide Groundwater

The groundwater outside of the four source areas considered within this FFS are addressed as site-wide groundwater. These areas are defined as groundwater within the identified boundary of the Southeast Rockford Groundwater Contamination Site.

Site-wide groundwater was addressed by a separate FS Report dated June 1995 (CDM, 1995). The record of decision (ROD) for site-wide groundwater was issued on September 29, 1995 (U.S. EPA, 1995). The 1995 ROD addressed compounds similar to those being evaluated within this FFS and included chlorinated VOCs, BETX compounds and ketones. The chosen remedy included natural attenuation of groundwater in the upper water-bearing zone. Groundwater monitoring, installation of public water service to selected homes and businesses, institutional controls, and potential hook-ups are included as part of the selected remedy. Therefore, site-wide groundwater will not be discussed herein.

The two media groups identified for technology screening for Source Areas 4, 7, 9/10, and 11 are as follows:

- Contaminated soil; and
- Contaminated leachate.

4.1.2 Potential Response Categories

General response actions are broad categories encompassing an array of technology types which may produce a similar result. Response actions are selected on the basis of their applicability to the characteristics and contamination at a given site. Some response actions may be capable of meeting all of the remedial response objectives alone, but combinations of response actions may prove to be more effective or less expensive. The following potential response categories have been deemed potentially applicable for the Southeast Rockford SCOU and will be discussed for each media of concern:

<u>No Action</u>

As a baseline for comparison, the NCP requires that the No Action response action be considered and carried through the detailed analysis. This option allows contaminants to continue to migrate via contaminated groundwater or other pathways, with only natural attenuation processes, such as adsorption, degradation, precipitation, and dispersion as avenues for intrinsic remediation. Long-term effectiveness of natural attenuation processes can be determined through environmental monitoring.

The No Action response must be evaluated in terms of the exposure and risk to human health and the environment. This evaluation must include estimating the baseline risk, present and expected, against which other responses can be compared. The No Action response may be deemed appropriate for soil or groundwater problems where natural environmental mechanisms are predicted to degrade or immobilize contaminants of concern and result in concentrations acceptable by U.S. EPA standards in a reasonable time period.

Limited Action

The Limited Action response encompasses a variety of technologies or procedures that restrict site access or use (such as through fence installation, groundwater use, or deed restrictions). In addition, this response may be selected for leachate where restoration is prohibited due to hydrogeologic factors, contaminant-related factors, and/or remediation system design limitations.

Containment Action

The Containment Action response involves little or no treatment, but focuses on reducing the mobility of contaminants of concern and associated risk of direct exposure, thereby protecting human health and the environment. Containment actions may include such technologies as covering (capping) or enclosing exposed or buried waste deposits. It may also include controlling leachate migration through construction of low-permeability subsurface physical containment walls (such as slurry walls) or construction of hydraulic barriers (such as groundwater collection wells or groundwater interception trenches).

Treatment Action

Treatment Action responses are designed to reduce the volume and/or toxicity of contaminants of concern. The treatment remedial response for leachate or soils allows for in-situ (such as bioremediation or soil vapor extraction) or excavation and on-site (such as groundwater extraction and treatment systems) technologies. These technologies range from relatively simple, highly understood and widely applied concepts to state-of-the-art innovative approaches with limited or nonexistent full-scale applications. The universe of these potential technologies will be paired down to a manageable number of candidate leachate options later in this section, prior to assembly into potential groundwater remedial alternatives. Potential technologies for VOCs in soil will be based on Presumptive Remedy guidance developed by U.S. EPA (U.S. EPA, 1993). However, Presumptive Remedy guidance may not be applicable for the removal of VOC "hot spots", nor fully address all areas of the Southeast Rockford SCOU. Therefore, additional soil technologies will be assessed for the site, if needed.

Disposal Action

The Disposal Action responses involve permanent removal of contaminated media to an on-site or off-site location such as a landfill or Waste Water Treatment Plant (WWTP). The landfill response prevents exposure to and reduces mobility of contaminants, but does not reduce the volume or toxicity of the contaminants. Treatment may be required as part of the disposal alternative.

4.2 Applicable General Response Actions and Remedial Technologies

Based on the characteristics of the media of concern, COPCs, remedial action objectives, and the final Risk Assessment (CDM, 2000), applicable general response actions have been developed. **Table 4-2** lists these general response actions with the corresponding media of concern (contaminated solids and leachate) and potential exposure pathways.

4.2.1 Contaminated Soils

Figure 4-1 presents the initial screening of the remedial technologies for contaminated soils.

No Action

The No Action response is required to be retained by the NCP. This response will result in leaving contaminated soils in-place and does not address the continued release of contaminants, primarily via air or as leachate to groundwater, to the environment from source areas nor does this alternative address the direct contact exposure pathway. The No Action response may be technically implementable where fate and transport analysis shows that degradation or retardation of contaminants will not result in an unacceptable risk to humans or the environment.

The No Action response for contaminated soils allows for the continued release of contaminants, primarily VOCs, to groundwater and surface water. The continued release of contaminants from source areas as leachate could prolong the time required for natural attenuation and increases the volume of contaminated leachate to be collected and disposed of. In addition, site-wide groundwater will be further degraded by shallow source area groundwater, thus lengthening the time to achieve ARARs for site-wide groundwater via natural attenuation. This alternative is retained for further consideration.

Limited Action

Similar to the No Action response, the Limited Action response generally allows for the continued release of contaminants. This response also consists of implementing site security measures, such as fencing and deed restrictions, to inhibit unauthorized access and direct contact with contaminated soils.

The following technology types comprise Limited Action responses: access restrictions and deed restrictions. The Limited Action response would be protective of human health and the environment. This response is technically implementable and is retained for further analysis.

Table 4-2
Southeast Rockford SCOU
Rockford, Illinois
Focused Feasibility Study
General Response Actions

Media	Exposure Pathways	General Response Actions	Comments
Contaminated Soils	Dermal contact with contaminated soils, inhalation of vapors and particulates	No Action	Natural attenuation.
		Limited Action	Control access to the site (fencing, etc.) and/or impose deed/use restrictions.
	Ability to continue to leach to groundwater or surface water.	Containment Action	Install a cap and/or vertical barriers to prevent direct contact with contaminated soils, and to reduce the potential for exposure to vapors and particulates, and to control groundwater migration.
		Treatment Action	Treat (biological, thermal, etc.) contaminated soils to reduce the toxicity.
		Disposal Action	Disposal of contaminated soils on-site or off-site to reduce or eliminate the potential for exposure.
Leachate	Ingestion of contaminated groundwater and inhalation of volatile chemicals from contaminated leachate.	No Action	Natural attenuation.
	Leachate impacts to surface water at discharge locations.	Limited Action	Impose use/deed restrictions; VOC leachate source removal via extraction wells
		Containment Action	Install vertical/horizontal barriers or a gradient control system (trenches and/or extraction wells) to limit migration of contaminants.
		Treatment Action	Treat (biological or physical/chemical) contaminated groundwater *in-situ* or aboveground (on- or off-site) to reduce the toxicity.
		Disposal Action	Discharge contaminated groundwater to stormwater drainage ditch or unnamed creek, or RCRA facility for off-site treatment and/or disposal.

General Response Action	Remedial Technology	Process Option	Descriptions	Screening Comments
No Action	No Action	Not Applicable	No action	Required by NCP as a baseline comparison
Limited Action	Access Use Restrictions	Fencing	Site would be fenced to limit direct contact with contaminated soils	Potentially applicable
		Deed Restrictions	Deeds for property in the area would include land use restrictions	Potentially applicable
Containment Action	Horizontal Barriers	Capping	Areas covered with low permeability soils or synthetic membranes to reduce infiltration.	Not applicable. Direct contact is not an exposure pathway for VOCs
Treatment Action	Biological Treatment	Aerobic	Degradation of organics using microorganisms in an aerobic environment.	Potentially applicable
		Anaerobic	Degradation of organics using microorganisms in an anaerobic environment.	Potentially applicable.
	Physical/Chemical Treatment	Vacuum Extraction (with or without air sparging)	Soil gas in the unsaturated zone is pumped out via an applied vacuum.	Potentially applicable.
		Chemical Reduction	Excavated soils are washed and treated with dechlorinating agents.	Not applicable for BTEX compounds and further treatment may be required
		Soil Flushing	Clean water is flushed through the contaminated solids and absorbed contaminants are transferred into the water and flushed away.	Not applicable due to low effectiveness of contaminant removal.
		Soil Washing	Excavated solids are contacted with a water/chemical additive mixture to strip absorbed contaminants from the solids.	Not applicable. Further treatment of wash water will be required.
		Vapor-Phase Carbon Adsorption	Adsorption of contaminants onto activated carbon by passing vapor through carbon column.	Potentially applicable to address vapors extracted from vacuum extraction system.
	Thermal Treatment	Radio Frequency Heating	Organic compounds are volatilized by heating the solids using RF electrodes.	Not applicable due to high cost and no additional benefits as compared to thermal desorption
		Incineration	Combustion of contaminants in the presence of oxygen	Not applicable since on-site incineration is not allowed in Illinois
		Thermal Desorption	Process where heat is applied to solids to drive off water and organic contaminants.	Potentially applicable above-ground following excavation
		Catalytic Oxidation	Process where heat is applied to contaminated vapor at low temperature using a catalyst.	Potentially applicable to address extracted vapor from vacuum extraction system.
	Off-site Treatment	RCRA TSD Facility	Contaminated solids destroyed in incinerator or other process unit	Not applicable due to high cost.
Disposal Action	On-site Disposal	Consolidation/ CAMU	Consolidation of contaminated solids at an on-site landfill	Not applicable.
	Off-site Disposal	RCRA Landfill	Disposal off-site at a permitted landfill with or without treatment	Not applicable due to Land Disposal Restrictions

Not applicable for this media

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

Figure 4-1
Screening of Technologies and Process Options for Contaminated Soils

CDM Camp Dresser & McKee

Containment Action

The Containment Action response involves isolating areas of contaminated media through physical or hydraulic controls. Containment technology types include horizontal barriers to intercept or block the downward vertical migration of contaminated groundwater and leachate from contaminated solids. Horizontal hydraulic barriers are created by reversing or neutralizing groundwater flow gradients into the horizontally contained area.

Physical barriers such as caps can isolate material from direct contact (simple soil cap) or also provide restrictions to stormwater infiltration or surface water erosion. The nature of the cap can vary in terms of areal extent, types of materials, design life, complexity, maintenance requirements, and construction cost. Typical caps consist of one or more of the following layers depending on the physical and chemical constituents of the underlying contaminated soils: topsoil, common fill, low-permeability clay, drainage layers, geomembranes, geotextiles, concrete mats, and geocomposite liners. A cap would require periodic inspections for maintenance of integrity. A capping system could provide an effective long-term barrier against direct exposure of humans to soils. In addition, a capping system would significantly reduce the infiltration of stormwater, thus reducing the generation of leachate and the subsequent migration of contaminants to groundwater. A capping system is technically implementable for this site and would be effective in reducing direct contact exposure for both SVOCs and VOCs. However, as discussed within Section 4.1.1, a remedial action to address SVOCs is not being considered at this time, and direct contact with VOCs is not an exposure pathway of concern for any of the four source areas. Therefore, capping has been eliminated from further consideration within this FFS.

Treatment Action

The Treatment Action response involves reducing the toxicity, mobility, and volume of contaminants in the media of concern. Specifically, treatment response options include biological, physical/chemical and thermal processes.

It is noted that the Presumptive Remedy guidance considered soil vapor extraction, thermal desorption, and incineration as appropriate to treat VOCs in soil. Therefore, this discussion for the treatment response action focuses on these technologies. However, it was deemed appropriate to also evaluate biological treatment, physical/chemical treatment (in addition to soil vapor extraction) and off-site treatment at this site.

Biotreatment Processes

Biological treatment processes use contaminant-utilizing microbes to destroy organic hazardous constituents and form less toxic products. For optimal biodegradation, sufficient quantities of nutrients such as nitrogen and phosphorus must be available. Other environmental conditions that affect bacterial growth include soil moisture content, temperature, oxidation-reduction potential, pH, and salinity. In some cases, modification of one or more of these conditions may be necessary to stimulate microbial growth. This technology can be applied either in situ, where the bacteria and nutrients are introduced into the waste material; by excavation and on-site land treatment; or by excavation and bioreactor treatment. In each of these cases, biodegradation may be enhanced by optimizing environmental conditions for contaminant degrading microorganisms. A brief summary of each of the biotreatment processes is provided below.

Enhanced In Situ Bioremediation

This process option involves treating the soils in place by injecting air and nutrients into the subsurface. This option could also be implemented to address residual contamination if air sparging with steam injection is employed in source areas. The addition of heat and oxygen to the subsurface could result in favorable conditions for in situ biodegradation to occur. In situ treatment technologies offer the advantage of unobtrusive treatment, thereby resulting in minimal surface disturbances and avoiding high excavation costs. Disadvantages may be long treatment times. Enhanced in situ bioremediation would be a feasible treatment strategy for this site due to the amenable geology/hydrology conditions and the nature of the target compounds.

Biopiles

Biopiles are aboveground soil piles with controlled, environmental conditions that enhance microbially-mediated reactions. This method of treatment is enhanced beyond in situ bioremediation by allowing for more thorough control and optimization of environmental factors that affect soil microorganisms (e.g., nutrient levels, soil moisture, soil temperature, and soil permeability to air flow). The advantages to biopile treatment are low to moderate capital cost, easy implementation, low overhead and maintenance costs, and shorter treatment times compared to land farming. The disadvantages associated with biopiles include increased material handling. Biopiles would be a feasible treatment technology for Area 7. For this area, biopile treatment would be more advantageous than excavation and on-site soil vapor extraction since biopile treatment would not require treatment of contaminants in the vapor stream.

Bioslurry Treatment

A slurry-phase bioreactor is a remedial alternative that can optimize environmental conditions and promote bioavailability of the absorbed contaminants by increasing microbe to contaminant contact. In slurry-phase bioremediation, excavated soils are treated as an aqueous slurry within a large mobile bioreactor designed to enhance mass-transfer kinetics. This system creates the ideal environment for rapid aerobic biodegradation by maintaining intimate mixing and microbial-contact with the contaminants. Biological slurry systems can be aerobic or anaerobic. With aerobic systems, air or pure oxygen is added to maintain proper dissolved oxygen levels for the microorganisms. Anaerobic systems are normally closed reactors which operate in the absence of oxygen. The advantages of this process are high contaminant/cell interactions, shorter treatment times, and minimal space requirements. The disadvantages primarily include high operational costs, increased material handling, sludge disposal considerations, and dewatering requirements with the potential necessity for secondary treatment of effluents. Due to the large volume of soils to be treated, bioslurry treatment would not be a feasible treatment technology for this site.

A biodegradation pilot study could be completed prior to full-scale implementation to evaluate the effectiveness of this biological treatment processes.

Physical/Chemical Treatment Processes

Four technologies were evaluated for the physical/chemical treatment: vacuum extraction, soil flushing, and soil washing. These technologies generally transfer the contaminants from the solid phase into the vapor or liquid phase. The vapor or liquid waste stream is subsequently treated (e.g., carbon or catalytic oxidation for vapor) or discharged to an appropriate facility.

Vacuum Extraction

Vacuum extraction is an in situ or aboveground treatment technique in which the soil gas within the unsaturated zone is extracted out of the pore spaces via an applied vacuum using one or more extraction well(s) or trench(es). Pressure gradients are created in the vadose zone to induce convective air flow through the porous media. As the contaminated gas is extracted from the ground, clean air from the surface is drawn into the contaminated zone and the VOCs are transferred from the liquid or solid matrix into the soil gas stream. Thus, the volatile contaminants are removed with the extracted air. Contaminant vapors may then be treated using catalytic oxidation or carbon adsorption. The vacuum extraction process is most effective for the volatile aromatic (BTEX) and chlorinated (TCE, TCA) compounds present at each of the source areas.

Most of the contaminated soils present that require treatment are in the saturated zone, therefore this technology could be effectively implemented in combination with air sparging or groundwater controls. Air sparging would transfer contaminants from the saturated to the unsaturated zone, where they could be collected using vacuum extraction. Therefore, vacuum extraction would be a feasible treatment technology for this site, but only in concert with air sparging.

Catalytic oxidation is used to treat vapor streams that do not have a high fuel value. The presence of catalyst allows for thermal treatment of vapors at a significantly lower temperature than systems that do not use a catalyst. The result is lower operational costs due to a lower amount of auxiliary fuel such as natural gas. The catalyst is a precious metal formation (e.g., platinum or palladium). There is the possibility that dioxins will be formed using catalytic oxidation, though at very low levels. Dioxin sampling would be conducted during the operation of the catalytic oxidation system.

Carbon adsorption is a common technology used to extract organic substances from air via collection on the adsorbent's surface. Contaminated air is passed through one or more vessels containing GAC. Contaminants sorb onto the surfaces of the activated carbon grains. Thermally processing carbon creates small porous particles with a large internal surface area. This processing activates the carbon. The activated carbon attracts and adsorbs organic molecules as well as certain metal and inorganic molecules. When the concentration of contaminants in the vapor exiting the vessels exceeds a certain level, the carbon must be replaced. Given the elevated concentrations of VOCs anticipated in the vapor, carbon adsorption would only be feasible for Area 9/10. For Areas 4 and 7, carbon would be feasible only after contaminant levels were reduced using catalytic oxidation for a period of up to six months to one year.

Soil Flushing

Soil flushing involves drawing clean water through contaminated solids using extraction/injection wells. The contaminants which are adsorbed to the solids are transferred into the water and removed from the subsurface. Contaminated water collected during this process would then require treatment. This method is most effective in removing compounds that exhibit high water solubility and low adsorption on the solid matrix. Due to the low effectiveness of contaminant removal, soil flushing would not be technically feasible for this site. Soil flushing is not retained as a means of treatment of the contaminated soils at this site.

Soil Washing

Soil washing is a physical mixing process in which excavated solids are contacted with water and chemical additives. The process promotes contaminant transport from the solid to the liquid phase to produce a treated solid and wastewater, which may require further treatment. The process removes contaminants via two mechanisms: 1) dissolution of contaminants into the washwater, and 2) removal of fine particulates (which often contain the majority of the adsorbed contaminants from the solid matrix). The wastewater can be treated using sedimentation, filtration, biological treatment, or carbon adsorption. Materials which contain large quantities of clays, silts, and other fine particles will result in soiled carryover into the washwater which would result in higher treatment costs. Various types of contaminants including metals can be treated using this technology. Washwater additives such as acids, surfactants, or chelating agents may be required. It is likely that all or most of the fine-grained contaminated soils would carry-over into the washwater which would require further treatment. Soil washing is also an excavation and on-site process. With contamination extending to considerable depth, excavation of all soil is technically impractical. Therefore, soil washing is not retained for further analysis.

Thermal technologies evaluated for the Treatment Action include incineration and thermal desorption. Generally, thermal treatment technologies involve driving organics out of solid material through heating.

Thermal Incineration

Thermal incineration involves the combustion of contaminant vapors in the presence of oxygen. Complete destruction of the contaminants requires very high temperatures, typically 1,000° to 1,400° F. Thermal incinerators may use an open flame or a combustion chamber. Incinerators generally use either a rotary kiln, circulating bed or infrared system. Most types of solid, liquid and gaseous organic wastes, including contaminated soils can be treated using incineration technologies. Wastes with a high heating value are especially favorable. The efficiency of treatment for wastes with high inorganic salt and metal content is limited. Thermal incineration would be effective for the treatment of "hot spot" soils at the source areas and is retained for further consideration.

Thermal Desorption

Thermal desorption is a solids drying process whereby heat is applied to contaminated solids at temperatures in the range of 300° to 1,000° F to drive off water and organic contaminants, resulting in a clean dry solid matrix. Subsequent treatment of the vaporized gases is accomplished via condensation, thermal oxidation or carbon adsorption. This material drying equipment may consist of a directly or indirectly fired rotary kiln, a hollow double auger system with a heat transfer fluid or a fluidized bed dryer. Thermal desorption is most effective in removing compounds that have a boiling point below 600° F such as PCBs, pentachlorophenols, hydrocarbons, and VOCs. Water content of the feed material is a significant parameter affecting the feasibility of this process. Moisture contents greater than 25 percent may be prohibitive. Solid characteristics such as small grain size, plasticity limits (stickiness and flow properties) and high organic content may decrease process feasibility. Additionally, the process separates the contaminants from the solid matrix, thus the resulting gas stream may need further treatment.

The thermal desorption process is less costly than thermal incineration and may be effective for the treatment of "hot spot" soils at the source areas. Therefore, thermal desorption would have similar results as incineration; however, it would be less expensive and would be implemented on site. Thermal desorption is retained for further analysis for the treatment of contaminated soils.

Off-site Treatment

Off-site treatment allows materials or wastes from the source areas to be removed completely from the site and treated at a full-scale fixed facility. Off-site treatment requires excavation, waste analysis, consolidation, and off-site transportation of source material. It entails identification of RCRA-permitted hazardous waste treatment, storage, and disposal (TSD) facilities with the capability and capacity to treat material removed from source areas. Off-site handling of source materials would require permits for transportation and disposal. Due to the high costs of off-site treatment and disposal, off-site treatment is not retained for further analysis.

Disposal Action

The disposal option includes those treatment technologies where contaminated soils are contained on-site or disposed of off-site. This technology involves soil excavation and transportation using standard equipment (e.g., rolloff or dump trucks). Several criteria must be met to dispose of solids in a RCRA landfill. RCRA requires that solids to be disposed of in landfills or surface impoundments cannot contain free liquids as defined by the paint filter test. Another requirement is compliance with the land disposal ban. The land disposal ban prohibits the land disposal of certain hazardous wastes unless specified contaminant concentration limits are not exceeded. Based on the origin and respective concentration of waste, the contaminates of concern at the Rockford SCOU are F-listed waste (F-1 through F-5). The concentrations of these F-listed wastes at the site are above the land disposal ban limits, and are therefore banned from landfilling.

The off-site landfill technology does not achieve a permanent remedy and, under the CERCLA amendments, off-site transport without treatment is a least-favored remedial action. Properly constructed and maintained landfills reduce the mobility of contaminants, but require long-term management efforts. Landfilling of the contaminated solids is technically implementable, however, since land disposal requirements will not be met, this technology is not retained for further detailed analysis.

Summary

The following technologies were retained for the remediation of the contaminated soils:

No Action
No Action

Limited Action
- Access Restrictions
- Deed Restrictions

Containment Action
- None

Treatment Action
- Biological (VOCs)
  - enhanced in situ bioremediation
  - biopiles
- Physical/Chemical (VOCs)
  - vacuum extraction
- Thermal (VOCs)
  - thermal desorption

Disposal Action
- None

4.2.2 Contaminated Leachate

Groundwater flow is generally confined to recognized aquifers at the site include the unconsolidated aquifer, dolomite aquifer and sandstone aquifer. The unconsolidated aquifer is more permeable than the dolomite or sandstone aquifers. Groundwater flow directions can be independent depending on the depth of interest. However, contaminants in groundwater at this site are largely confined to the unconsolidated aquifer. For this FFS, shallow groundwater located inside the GMZ source area is defined as contaminated leachate. Therefore, technologies discussed in this section will address only contaminated leachate in the unconsolidated aquifer.

Figure 4-2 presents the screening of the remedial technologies for the contaminated leachate in the unconsolidated aquifer. The technology screening is summarized in the following paragraphs:

No Action

The NCP Paragraph 300.430(e)(6) states that to the extent it is both possible and appropriate, the No Action response action shall be developed as part of the Feasibility Study. The No Action alternative allows contaminants to continue to migrate via leachate contaminated and potentially contaminated surface water, with only natural attenuation processes, such as adsorption, degradation, precipitation, and dilution managing migration. Monitoring and deed restrictions are included as part of the No Action remedial response.

General Response Action	Remedial Technology	Process Option	Descriptions	Screening Comments
No Action	Deed Restrictions	Use Restrictions	Deeds for property in the area would include groundwater use restrictions	Required by NCP as a baseline comparison
		Natural Attenuation	Leachate degraded by natural processes	Required by NCP as a baseline comparison
Limited Action	Vertical Barriers	Extraction Wells	Direct leachate flow upward by lowering leachate levels within the area of concern	Potentially applicable
	Deed Restrictions	Use Restrictions	Deeds for property in the area would include groundwater use restrictions	Potentially applicable
Containment Action	Vertical Barriers	Slurry Wall, Extraction Wells, Interception Trenches	Areas enclosed with a physical wall or hydraulic barrier to contain and collect leachate	Potentially applicable
	Horizontal Barriers	Jet-grouted bottom seals	Pressure injection of grout at depths through closely spaced drilled holes	Not applicable. Depth to bedrock is greater than 50 feet
		Extraction Wells or Trenches	Direct leachate flow upward by lowering leachate levels within the area of concern	Potentially applicable. Trenches are eliminated
Treatment Action	Biological Treatment	Aerobic	Degradation of organics using microorganisms in an aerobic environment	Not applicable. Biodegradation would occur at very slow rates
		Anaerobic	Degradation of organics using microorganisms in an anaerobic environment	Not applicable. VOC concentrations are too high
	Physical/ Chemical Treatment	UV Oxidation	Oxidizing agent is used with UV light as catalyst to convert organics into carbon dioxide and water	Not applicable due to leachate having high levels of VOCs
		Precipitation	Dissolved inorganics are transformed into a solid phase for subsequent removal	Not applicable since dissolved inorganics are not a concern
		Air Stripping	Mixing large volumes of air with leachate in a packed column to promote transfer of VOCs to air	Potentially applicable
		Liquid-Phase Carbon Adsorption	Adsorption of contaminants onto activated carbon by passing leachate through carbon column	Not applicable due to leachate having high levels of VOCs
		Vapor-Phase Carbon Adsorption	Adsorption of contaminants onto activated carbon by passing vapor through carbon column	Potentially applicable for contaminated vapor from air stripper
		Catalytic Oxidation	Process where heat is applied to contaminated vapor at low temperature using a catalyst	Potentially applicable for contaminated vapor from air stripper
		Reverse Osmosis	Use of high pressure to force leachate through a membrane leaving inorganic contaminants behind	Not feasible since inorganics are not a concern
		Ion Exchange	Leachate is passed through a resin bed where ions are exchanged between resin and water	Not applicable since inorganics are not a concern
	In-situ Treatment	Air Sparging	Injection of air to strip VOCs from leachate and saturated soil, used with a soil vapor extraction system	Potentially applicable
		Permeable Treatment Beds	Downgradient treatment zones backfilled with catalytic or adsorptive media to remove contaminants	Not applicable due to excessive maintenance
		Barrier wall (Reactive)	Areas enclosed with a physical wall or hydraulic barrier allowing leachate to pass through reactive media	Potentially applicable
Disposal Action	On-Site Discharge	Reinjection to groundwater	Treated leachate discharged to an on-site groundwater system	Not applicable due to high treatment flow rate
		Surface Water	Extracted leachate discharged to an on-site surface water body	Potentially applicable following collection and treatment
	Off-Site Discharge	Surface Water	Extracted leachate discharged to an off-site surface water body	Potentially applicable following collection and treatment
		WWTP	Extracted leachate, discharged to local WWTP for treatment/disposal	Not applicable. Local WWTP ordinance prohibits remediation leachate treatment
		RCRA Facility	Extracted leachate discharged to RCRA facility for treatment and/or disposal	Not practical due to high volumes of leachate

Not applicable for this media

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Figure 4-2
Screening of Technologies and Process Options for Leachate

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The No Action response must identify or estimate the baseline risk, present and expected, against which all other responses can be compared for their effectiveness. This response may be selected for groundwater responses where natural environmental mechanisms are predicted to degrade or immobilize the contamination within a reasonable time period and will result in concentrations of constituents in groundwater that pose an acceptable risk. The NCP requires that the No Action response be retained in the evaluation.

Limited Action

Under the Limited Action remedial response, deed or use restrictions may be used to reduce the potential for exposure. Monitoring and deed restrictions are the technologies evaluated under the Limited Action response for the unconsolidated aquifer. In addition, extraction wells are considered a part of the Limited Action response to address source leachate. Limited Actions may be used during the implementation of another remedial action and, where necessary, as a component of the complete remedy.

The Limited Action response is retained for further screening.

Containment Action

The Containment response action for leachate involves the physical containment of groundwater using vertical and horizontal barrier walls or the hydraulic containment through the use of wells or trenches that create a reversal of groundwater flow gradients into the source area.

Vertical Wall Barriers

Vertical barriers are constructed to contain and prevent the migration of leachate originating from contaminated solids. Vertical barriers are typically used when:

- The vertical containment barrier can be extended to such depth beneath the contamination that it prevents migration of contamination beneath the barrier (e.g., "hanging wall"); or
- The overburden flow zone is underlain by a low permeability layer, such as clay, till, or non-fractured bedrock, into which a barrier can be extended to cut off the migration of groundwater (e.g., fully penetrating cut-off wall).

Containment of the contaminant plume can be achieved through plume encapsulation by placing an impermeable slurry wall at the limits of the plume. In this method, a trench is excavated through a bentonite-water slurry. During excavation, the trench is backfilled with a mixture of the excavated material and bentonite, or a cement-bentonite mixture. This technique is an effective method of creating an impermeable barrier to prevent further migration of the contaminant plume and is probably the most widely used containment technique. The slurry wall would have to extend over the entire perimeter of the downgradient portions of the GMZ and be keyed into the shale bedrock (approximately 40 feet to 130 feet across the site). Depth to bedrock is greater than 60 feet at Source Areas 9/10 and 11. Installation of a slurry wall at depths greater than 60 feet would be very costly. Therefore, slurry wall would only be feasible at Areas 4 and 7. This approach can be implemented using standard engineering techniques and methods. Slurry walls will be retained for further analysis.

Wells and Trenches

Horizontal and vertical migration can also be addressed through the use of interception trenches and extraction wells alone to create hydraulic controls. Trenches and wells are installed within the area of concern and groundwater levels are depressed to predetermined levels to create inward gradients of sufficient aerial extent. The lower groundwater levels induce flows from the higher groundwater levels outside of the contained area and back into the source area. This technique is most effective in permeable homogeneous soils where preferential flow paths do not exist. At the Southeast Rockford source areas, the overburden soils generally exhibit lower to moderate permeability and the shallow water-bearing zone is moderately to highly fractured bedrock. The presence of bedrock fractures in the intermediate zone could cause local circumvention of the areas of influence for both the wells and trenches if installed within the shallow water-bearing zone. However, the gradients could be influenced beyond the depth of the trenches or wells depending on spacing and pumping rates.

Therefore, gradient reversal through the use of pumping wells and trenches is retained for detailed analysis. Interception trenches are generally used to collect groundwater where soil permeabilities are too low for extraction wells to efficiently remove contaminated groundwater within a reasonable time period or to permit reasonable well spacing. The unconsolidated aquifer in Area 7 includes low permeability zones, as well as higher permeability units comprised of sand and gravel. Therefore, interception trenches are retained as a groundwater collection response, but only for Source Area 7, as this situation does not exist at other source areas.

Extraction wells installed to depth are the logical approach to groundwater recovery at Source Areas 4, 7, 9/10 and 11. These extraction systems are retained for detailed analysis.

Horizontal Barrier Walls

Horizontal barriers can include physical grouting or hydraulic controls beneath the groundwater of concern. Bottom seals can be installed through pressure grouting with micro fine cement to physically block vertical flow. However, this technology is not usually effective in areas where depth to bedrock is greater than 50 feet (as discussed for contaminated solids). Therefore, jet-grouted bottom seals are not retained for detailed analysis.

Treatment Action

Treatment action includes reduction of toxicity, mobility and volume of groundwater contamination through biological, physical/chemical and thermal processes.

Biological treatment methods use microbes to treat organic hazardous constituents. Organic matter provides the carbon source necessary to sustain bacterial growth and activity. The breakdown products of biodegradation are dependent on the organics present and the environment. Under aerobic conditions, organic compounds are ultimately mineralized to carbon dioxide and water. In an anaerobic environment, the major breakdown products are methane, ammonia, and water. Aerobic biodegradation is more commonly used in the treatment of hazardous waste leachate streams.

In situ Bioremediation

In situ bioremediation involves the introduction of appropriate substrates and additives to enhance the capability of microorganisms to degrade in place the contaminants of concern. Substrates include primary food sources such as acetate or methanol, and cometabolites such as methane. Additives include oxygen, either as air or as dilute hydrogen peroxide (H2O2), to promote aerobic biodegradation, and, potentially encourage bacterial cultures to augment the naturally occurring organisms. In situ biodegradation requires installation of either horizontal or vertical injection wells or trenches for addition of appropriate nutrients, electron acceptors/donors, and primary substrates that enhance growth of indigenous bacteria capable of degrading chlorinated VOCs. Other factors that affect in situ biodegradation are:

- pH (near neutral is optimal) and buffering capacity of the aquifer;
- Degree of saturation (particularly for treatment in the vadose zone);
- Hydraulic conductivity of the aquifer (for adequate delivery of injected compounds);
- Temperature;
- Types and concentration of contaminants; and
- Distribution of contaminants.

Limitations to in situ biodegradation arise from alteration of the subsurface environment resulting in undesirable side effects such as:

- Precipitation of metallic oxides and hydroxides, particularly iron and manganese;
- Plugging of the aquifer due to microbial growth; and
- Addition of substrates for microbial growth which are themselves detrimental to water quality, such as nitrogen compounds and aromatics.

As discussed above, there are several limitations associated with this technology. Biological treatment processes are sensitive to pH, temperature, flow conditions, and organic concentrations. Many chlorinated VOCs biodegrade at very slow rates. Even if removed in a pretreatment process, these compounds can still be produced as breakdown products from biodegradation of other compounds. The contaminants for Source Areas 4 and 9/10 include very high levels of chlorinated VOCs, and therefore, biological treatment would not be a feasible option. However, if air sparging is implemented, the addition of oxygen (and heat if steam injection is employed) to the subsurface could result in favorable conditions for in situ biodegradation to occur, thus continuing to remediate residual contaminants that remain in the subsurface. For Source Area 11, where the contaminants of concern are petroleum compounds, biological treatment would be effective. For Source Area 7, a clay layer exists at most areas at the depth of contamination and biological treatment would not be very effective since clay would act as an impermeable barrier.

Biological treatment as a primary remediation is not retained for detailed analysis for groundwater. However, in situ bioremediation as a polishing step for residual contamination is a feasible treatment strategy that should be evaluated after implementation of the remedial action.

Physical/Chemical Treatment Technologies

Presumptive Response Strategy and Excavation and On-site Treatment Technologies for Contaminated Groundwater at CERCLA Sites Final Guidance document (U.S. EPA 1996) indicates that detailed evaluation of treatment technologies for extracted groundwater/leachate is not necessary. Based on the guidance, three physical/chemical treatment technologies deemed to be most applicable for VOCs in leachate were evaluated: ultraviolet (UV) oxidation; air stripping; and carbon adsorption.

UV oxidation is an innovative technology implemented for the treatment of low level VOCs found in groundwater. The technology employs the use of an oxidizing agent along with UV light as a catalyst to convert organic chemicals into carbon dioxide and water. Strong oxidizing agents that are commonly used include hydrogen peroxide, chlorine gas, chlorine dioxide, sodium hypochlorite, ozone, and potassium permanganate. The UV system typically includes the UV oxidation reactor chamber (with UV lamps), a hydrogen peroxide system and a catalytic ozone decomposition unit. The benefits of this technology include on-site destruction with the potential for little or no air emissions. UV oxidation is best applied to groundwater with organic concentrations in the range of 0.1 to 10 ppm. The results of previous groundwater sampling at the site indicate that UV oxidation would be effective for the reduction of VOCs in leachate at the Southeast Rockford source areas.

Air stripping is a physical process commonly used to remove VOCs from groundwater. The process involves the flow of contaminated water cascading down a packed column while a countercurrent flow of air or steam is introduced at the bottom of the column. Stripping towers are typically packed with material designed to maximize surface area while minimizing pressure loss. The mechanism for action is the mass transfer of solutes from the water into the gas phase through intimate contact between gas and liquid. High suspended solids may cause channeling and clogging of the packing material. Therefore, pretreatment may be required. Air stripping is a technically implementable technology for VOC treatment, and is retained for detailed screening.

Carbon adsorption is a common technology used to extract organic substances from groundwater via collection on the adsorbent's surface. Adsorption is a physical phenomenon whereby the molecular forces between the adsorbent and the solute(s) are greater than those between the solvent and the solute(s). The solute will leave the solution and be adsorbed onto the surface of the activated carbon. This will occur until the activated carbon is saturated and becomes spent. Given the elevated concentrations of VOCs anticipated in leachate at Areas 4, 7, and 9/10, carbon adsorption would only be feasible as a polishing step. Therefore, this technology is not retained for detailed analysis.

Although, UV oxidation and air stripping are both feasible technologies for excavation and on-site treatment of VOCs in leachate at the site, this FFS assumed air stripping would be the most cost effective technology and is retained for detailed analysis.

Three in-situ treatment technologies were evaluated for the leachate: air sparging, permeable treatment beds, and reactive barrier walls. The advantage of in-situ technologies is that collection and disposal of leachate after treatment is not necessary.

Air sparging has been demonstrated to be a successful and cost-effective remediation technology for removing VOCs from saturated soils. This technology involves the controlled application of air pressure to induce bubbling within the soils residually saturated with VOCs. As the air passes through the contaminated soils, both dissolved contaminants and contaminants which are absorbed to soils are transferred into the vapor phase. The stripped contaminants are subsequently transported in the air phase to the vadose zone where the contaminants are either released to the atmosphere or collected via a vacuum extraction system. Additionally, by introducing oxygen into the saturated soils, the natural biodegradation processes may be enhanced.

In order for air sparging to be considered for specific contaminants, contaminants must have a dimensionless Henry's Law Constant above 0.01, a vapor pressure above 0.1 mm Hg, and a partition coefficient of less than 1,000 to be physically removed by air sparging. Soils must have a hydraulic conductivity of greater than 1E-05 cm/sec, and continuous lenses of significantly different permeability cannot be present in the saturated zone. Additionally, a saturated thickness of at least 5 feet must exist for sparging to be effective. Based on contaminants of concern and subsurface characteristics, air sparging would be amenable at the site and is therefore retained for further screening.

Multi-Phase Extraction (MPE) can be generally defined as the applicable of a vacuum to an extraction well, resulting in the extraction of a combination of the following phases—non-aqueous phase liquids (NAPLs), groundwater and soil vapor. The applied vacuum typically extracts soil vapors and enhances groundwater and NAPL recovery. There are several configurations of MPE that have been used, depending on the phases of contaminant present (e.g., light versus dense NAPLs) and the subsurface conditions. The extent of effective remediation of an MPE well is dependent on the extent of groundwater drawdown that is achieved. The greater the volume of soil that is dewatered, the greater the volume of soil that is remediated by SVE that is induced during MPE. In addition, the greater drawdown, the greater the groundwater and NAPL (if present) recovery rate. The subsurface conditions and contaminants at the site make MPE applicable for remediating source soils. The target soils are moderately permeable and the contaminants are all volatile thus providing conditions that are favorable for removal of contaminants in the vapor phase during MPE. Therefore, MPE is retained for further evaluation.

Permeable treatment beds are essentially excavated trenches placed perpendicular to groundwater flow and filled with an appropriate material to treat the contaminated groundwater as it flows into the trench. Some of the materials that may be used in the treatment bed are limestone, activated carbon, and synthetic ion exchange resins or catalysts. Materials, such as limestone, could remove dissolved metals through precipitation. VOCs can be removed using activated carbon.

Potentially, numerous problems exist in using a permeable treatment bed. These include: saturation of bed material; plugging of the bed with precipitates; and short life of bedding materials. These problems would require frequent evaluation and/or replacement of the bedding materials. Since leachate flow may elude the trenches, and bed materials would have to be replaced too frequently, permeable treatment beds are not retained for detailed screening.

Reactive barrier walls involve construction of permanent or semi-permanent replaceable units across the flow path of a contaminant plume. As the contaminated groundwater moves passively through the treatment wall, the contaminants are removed by physical, chemical and/or biological processes, including precipitation, sorption, oxidation/reduction, fixation, or degradation. These mechanically simple barriers may contain metal-based catalysts, chelating agents, nutrients, and oxygen. Permeable reactive walls potentially can degrade or immobilize contaminants in situ without any need to bring them up to the surface. They also do not require continuous input of energy, because a natural gradient of groundwater flow is used to carry contaminants through the reaction zone. Only periodic replacements or rejuvenation of the reaction medium might be required after its capacity is exhausted if it becomes clogged by precipitants and/or microorganisms.

Reactive barrier walls would be feasible for all source areas except Source Area 11 since the contaminants of concern at this source area, predominantly ETX, would be more effectively treated using other technologies. Therefore, reactive barrier walls are retained for detailed analysis for Source Areas 4, 7, and 9/10.

Disposal Action

This response would involve discharging the collected groundwater on-site or off-site following treatment, if necessary. On-site discharge is only applicable when the alternative includes groundwater extraction, treatment, and discharge. This technology would be used to discharge groundwater into either the on-site groundwater system or an on-site surface water body. Impacts to the surface water body or groundwater system would have to be evaluated to understand the impacts of this discharge. Discharges to surface water may be monitored for compliance with the National Pollution Discharge Elimination System (NPDES), MCLs, creek background water quality, and ecological surface water quality requirements. Discharges to the groundwater system would need to be in compliance with applicable groundwater discharge standards. Discharge to groundwater would be accomplished using a series of injection wells. Based on the large volume of treated leachate to be disposed, discharge to an on-site groundwater system is not retained for further analysis. On-site discharge to surface water is retained for further screening.

Off-site discharge would involve removing contaminated groundwater completely off-site to a Waste Water Treatment Plant (WWTP), Treatment Storage and Disposal (TSD) facility, or surface water body. This entails the removal of groundwater, possible pretreatment, and containerization for off-site transportation, including possible pipeline construction. All necessary permits for off-site disposal, including those for transportation will be required.

After treatment, collected groundwater could be transported from the Southeast Rockford four source areas to an off-site surface water body. An appropriate off-site surface water body would have to be selected for discharge. Impacts to the surface water would have to be evaluated. Off-site discharge to a surface water body is retained for further screening.

Off-site discharge also allows groundwater to be completely removed from the site and disposed at a WWTP or TSD. Groundwater may need to be pretreated to meet the influent standards and the facility would need to have the required capacity available.

The Rock River WWTP is located adjacent to the site. Based on a telephone conversation with the WWTP, the facility indicated that they could not accept contaminated leachate from the SCOU. Therefore, discharge to a WWTP is not retained for further analysis at this time.

Due to the excessive volumes of Southeast Rockford source area, leachate that would require treatment (up to 3,200 gpm), it would be difficult to find a TSD facility with the required capacity. Therefore, discharge to a TSD facility is not retained for further analysis.

<u>Summary</u>

The following technologies were retained for the remediation of leachate at the Southeast Rockford SCOU:

<u>No Action</u>
- Deed/Use Restrictions
- Natural Attenuation

<u>Limited Action</u>
- Deed/Use Restrictions
- Vertical Barrier
  - extraction wells

<u>Containment Action</u>
- Vertical Barrier
  - extraction wells
  - interception trenches
  - slurry wall

<u>Treatment Action</u>
- Physical/Chemical Treatment (air stripping)

In situ Treatment
- Air Sparging
- Reactive Barrier Wall
- Multi-Phase Extraction

Disposal Action
- Off-Site Discharge
  - surface water
- On-Site Discharge
  - surface water

Section 5 Development and Preliminary Screening of Remedial Alternatives

5.1 Development of Alternatives

This section describes the rationale for the combination of media-specific process options into comprehensive remedial alternatives. An appropriate range of alternatives was developed based on the initial screening of technologies, the potential for contaminants to impact the environment, and specific criteria for the source areas at the SCOU.

U.S. EPA has developed presumptive remedy directives from past experience with the objective of streamlining site investigations and facilitating the selection of remedial actions. The directive on presumptive remedies for soils contaminated by VOCs is appropriate for addressing the types of contaminants found in the source areas at the Southeast Rockford site. The source area presumptive remedies considered implementable for this site include soil vapor extraction and thermal desorption. Excavation and on-site bioremediation has also been considered in Area 7 as an alternative to thermal desorption of excavated material. For this source area, excavation and on-site bioremediation would require a longer timeframe than soil vapor extraction to achieve ARARs. However, excavation and on-site bioremediation would be more advantageous than excavation and on-site soil vapor extraction since bioremediation would not require treatment of contaminants in the vapor stream. Since presumptive remedies have been identified that are feasible, the technology identification and screening steps are not necessary. Presumptive soil remedies have been assembled into remedial alternatives that will be evaluated in the detailed analysis in Section 7. These alternatives are presented on **Figures 5-1** through **5-4** for Source Areas 4, 7, 9/10, and 11, respectively.

Therefore, preliminary screening will be performed on leachate remedial alternatives only as presented herein.

5.1.1 Leachate Source Control

To assemble alternatives, general response actions were combined to form complete remedial responses for the media of concern in each source area. The detailed remedial approach considered the specific extent, depth, and mobility of contaminants as well as site-specific area constraints and hydrogeology for the individual source area. Leachate source control shall address residual contamination not addressed by soil remediation alternatives (other than No Action).

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Section 5
Development and Preliminary Screening of Remedial Alternatives

5.1 Development of Alternatives

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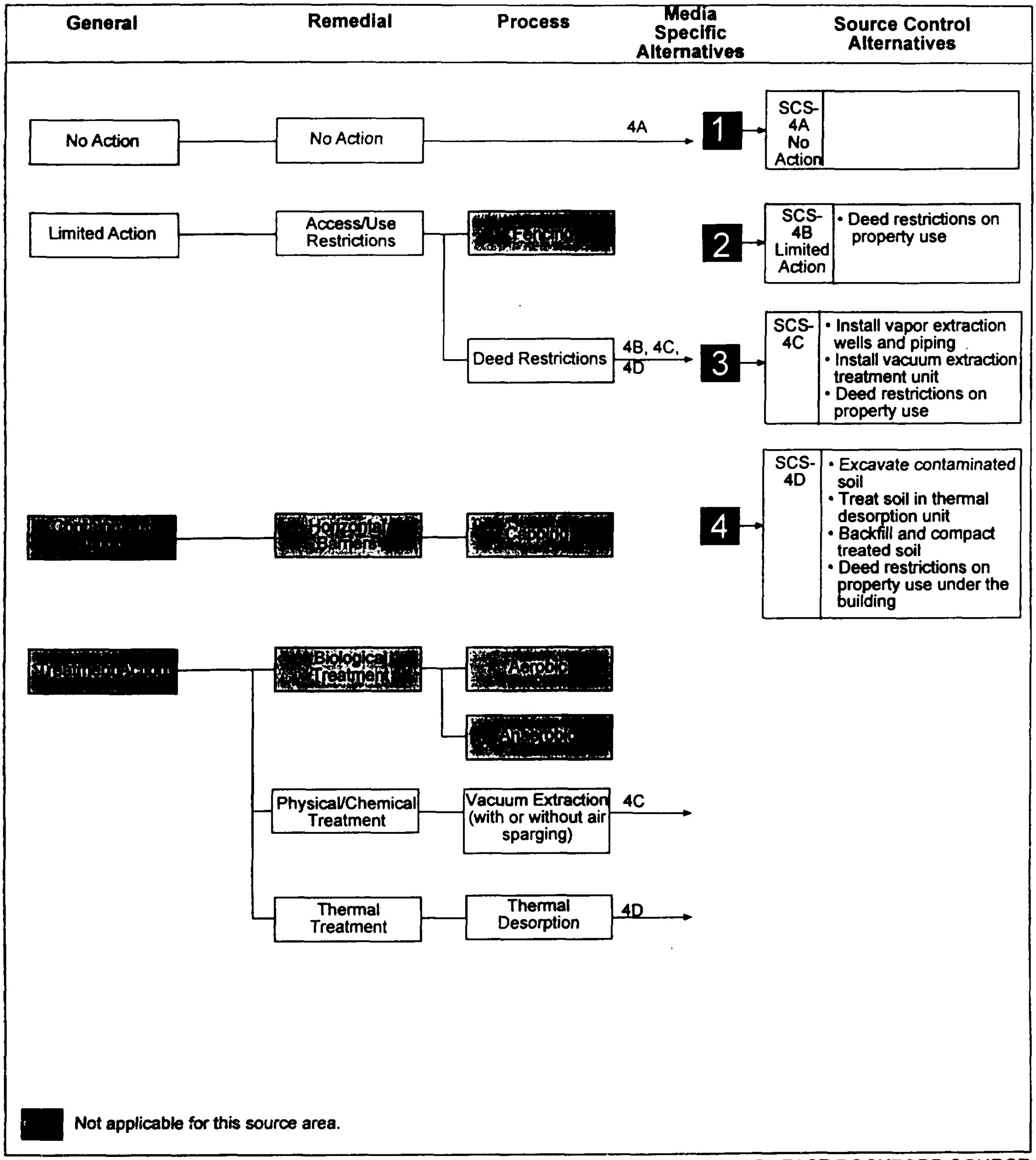

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Figure 5-1
Development of Contaminated Soil Source Control Alternatives for Area 4

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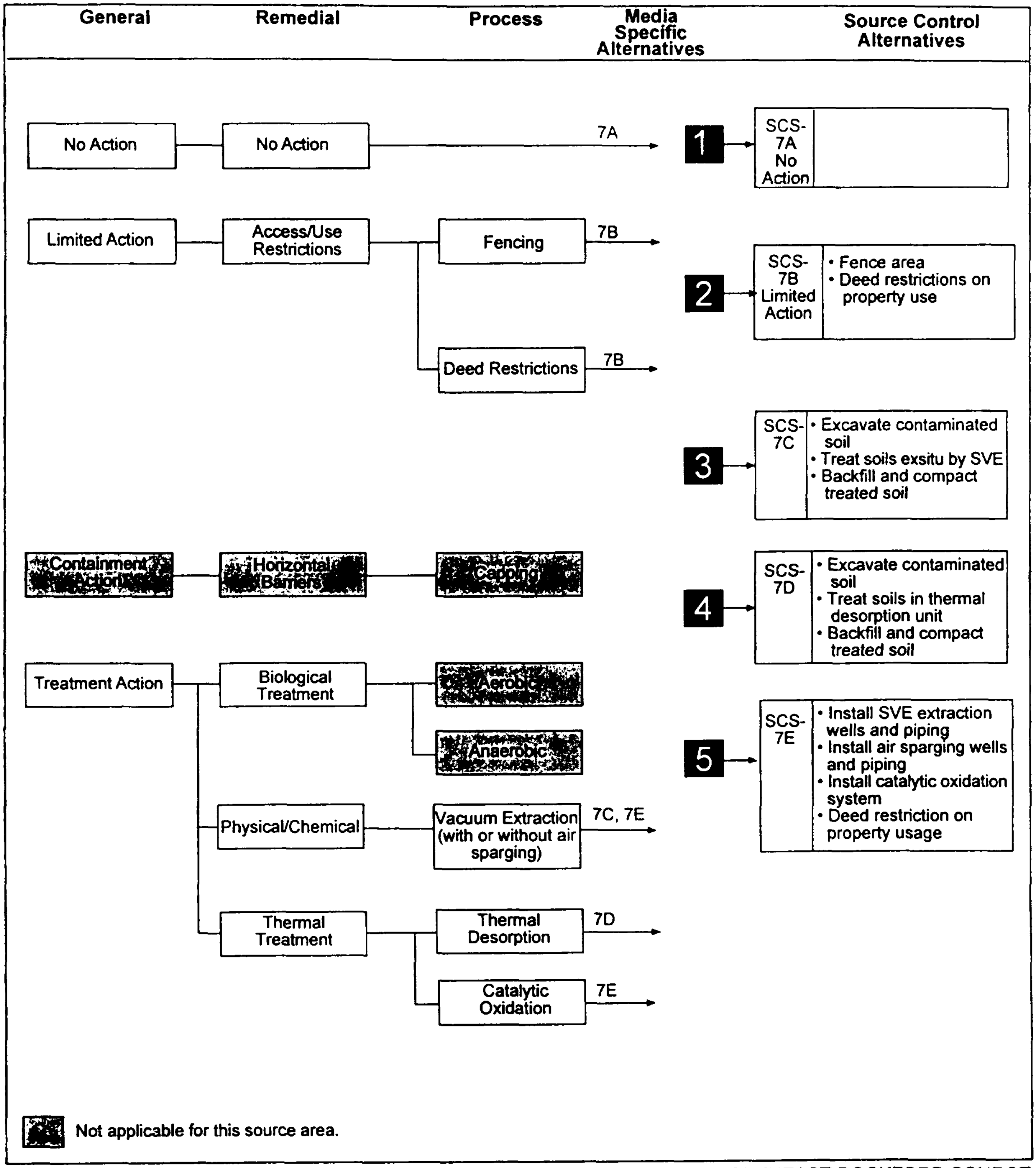

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Figure 5-2
Development of Contaminated Soil Source Control Alternatives for Area 7

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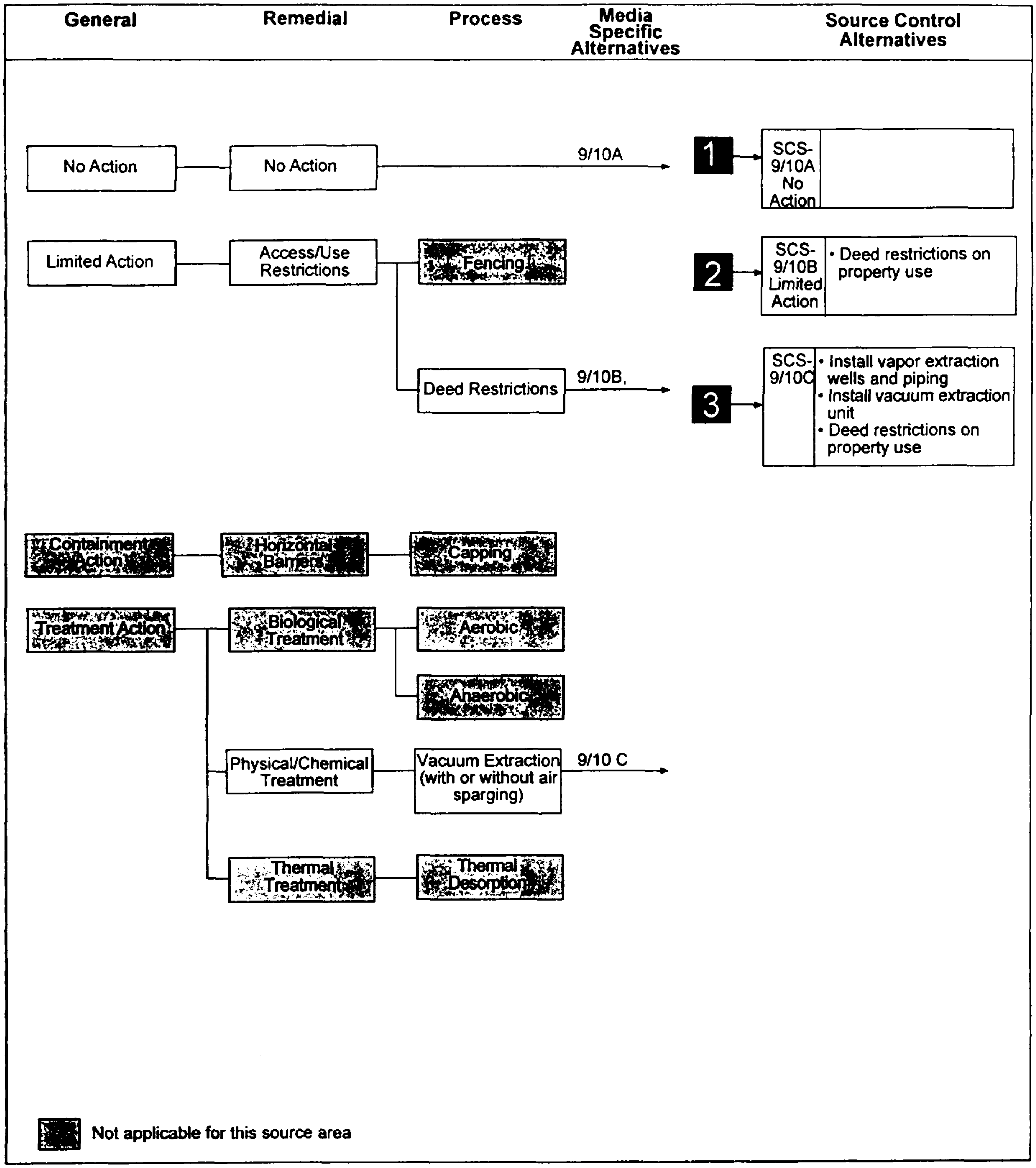

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Figure 5-3
Development of Contaminated Soil Source Control Alternatives for Area 9/10

CDM Camp Dresser & McKee

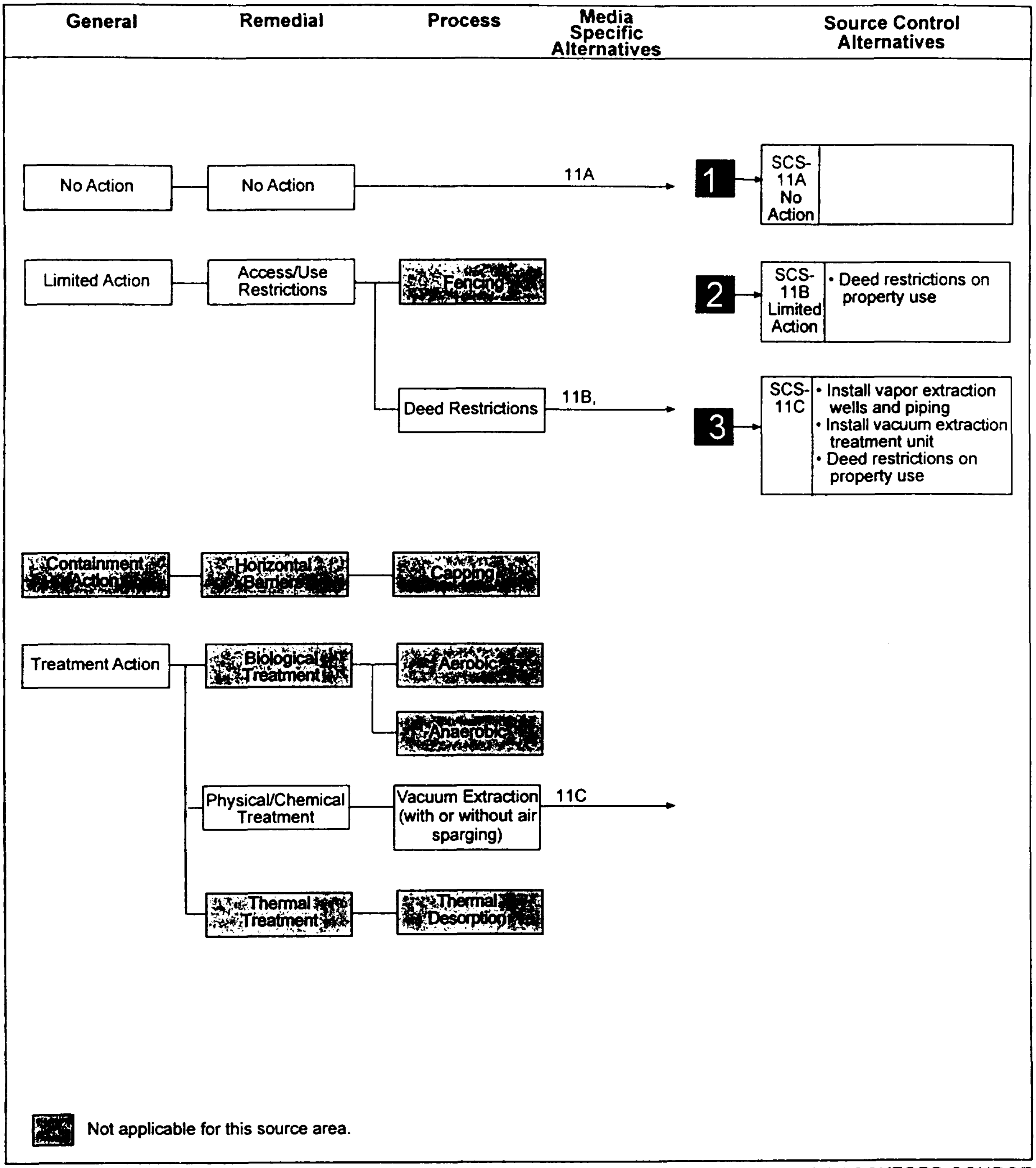

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Figure 5-4
Development of Contaminated Soil Source Control Alternatives for Area 11

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Leachate source control includes contaminated leachate in the shallow water-bearing zone. Leachate is assumed to be contamination originated from the soil source areas that could or has migrated to the unconsolidated acquifer within the designated GMZ for each source area. Contaminated source leachate is defined for this FFS hereafter as shallow groundwater located inside the GMZ source area. The groundwater located outside the GMZ of the source areas was evaluated as part of management of migration of sitewide groundwater, and is not addressed as part of this FFS.

The leachate source control alternatives were formulated to address the remediation for each source area. Leachate source control alternatives were developed for the following areas:

- Source Area 4;
- Source Area 7 and;
- Source Area 9/10

As noted in the fate and transport analysis, Source Area 11 does not appear to require leachate source control based on the modeling results which indicate ARARs are attained at the GMZ boundary (see Section 6).

5.2 Screening of Alternatives

5.2.1 Methods of Evaluation

The screening of alternatives was performed in three steps. First, the potentially applicable technologies from Section 4 were reviewed for application to the specific source area. Second, the technologies were assembled into alternatives that completely addressed the source area and were further refined to be site-specific. Third, the alternatives were generally evaluated to determine their overall effectiveness, implementability, and cost. A decision was then made based on an evaluation of whether the alternative should be retained for further evaluation in the Detailed Analysis of Alternatives in Section 7. Alternatives with the most favorable composite evaluation of all three of the screening criteria were retained for further consideration.

As required by the NCP, the No Action alternative will be retained for detailed analysis to serve as a basis for relative comparison with other alternatives. At the direction of IEPA, the No Action alternative will include leachate monitoring and institutional controls.

Defined alternatives were evaluated against the short-term and long-term aspects of three broad criteria: effectiveness, implementability, and cost. Each of these criteria is defined as follows:

Effectiveness

A key component of the screening evaluation is the effectiveness of each alternative in protecting human health and the environment. Each alternative was evaluated relative to the degree of protection it will provide and the potential reduction in toxicity, mobility, and/or volume of contaminated media it will achieve. Both short- and long-term components of protectiveness were evaluated: short-term refers to changes which occur during the construction and implementation period; long-term refers to changes in one or more characteristics of the hazardous substances of contaminated media caused by treatment or other means.

Implementability

Implementability is a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative.

Administrative feasibility refers to the availability of treatment, storage, and disposal services and capacity, permitting considerations, and the requirements for (and availability of) specific equipment and technical specialists. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete; it also includes maintaining, replacing, and monitoring technical components of this alternative, if required, after the remedial action is completed.

Cost

The objective of developing cost estimates during screening of alternatives is to make comparisons between alternatives with relative accuracy. These costs are for screening purposes only, and are qualitative in nature. The basis for screening cost estimates included cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar cost estimates, modified as needed by specific site characteristics. It includes consideration of capital construction, periodic replacement, and operation and maintenance costs. It should be noted that for the purpose of this cost analysis the level of detail will only permit the alternatives to be given a relative ranking of high, medium, or low for overall cost. A more detailed cost analysis of the retained alternatives will be performed in Section 7.

5.2.2 Source Control Alternatives for Leachate in Source Area 4

Based on the results of previous groundwater sampling conducted at the site, elevated levels of 1,1,1-TCA have been discovered in groundwater monitoring wells located downgradient from the former Swebco facility. Groundwater contaminant levels near the site present an unacceptable risk to public health and the environment. Prior site investigations revealed that the impacts identified in downgradient groundwater monitoring wells were a result of elevated VOC impacted soils located beneath the former Swebco facility parking lot. Based on the fate and transport analysis (see Section 6), the contaminated soils are leaching elevated levels of contaminants into the groundwater. This leachate is potentially degrading groundwater quality in the source area and downgradient areas.

Figure 5-5 presents the development of leachate source control alternatives for Source Area 4. As shown on **Figure 5-5**, a number of potential technologies were eliminated from development of alternatives for leachate management for site-specific reasons. Vertical barriers consisting of slurry walls and interception trenches were eliminated from further consideration during the initial leachate management screening. Slurry walls were removed because the leachate source area is confined to a small source area and containment would be better addressed by a limited number of extraction wells. The interception trenches were eliminated because the vertical extent of leachate contamination is at depths greater then 30 feet and therefore, the source area leachate would also be better addressed by extraction wells.

The reinjection of treated leachate to groundwater and discharge to the Rock River Water Reclamation District (RRWRD)(local WWTP) scenarios were both eliminated. The site characteristics indicate that reinjection of treated leachate on-site is not feasible. The calculated rate of potential reinjection of treated leachate is much larger than the potential recharge allowance for Area 4. Additionally, the RRWRD wastewater treatment plant is unable to accept waste water from remediation projects. Currently, the RRWRD WWTP is at or near flow capacity. The RRWRD has issued a local ordinance limiting the quantity of environmental remediation wastewater being accepted. If no other feasible option exists for leachate disposal, a formal appeal may be made to the RRWRD to accept leachate. Therefore, the only viable option available is discharge to an on-site local surface water, (a stormwater drainage ditch) located 200 feet northwest of the source area. In order to accomplish discharge on-site, the treated leachate would be required to meet fresh water criteria, a permitted NPDES discharge quality, MCLs, or TACO groundwater remediation objectives.

The following source control alternatives were developed for Source Area 4:

SCL-4A: No Action/Leachate Monitoring/Restrictions on Groundwater Usage, Natural Attenuation

This alternative would consist of no action with leachate monitoring, deed restrictions on groundwater usage and natural attenuation of leachate for Area 4. Currently, no groundwater wells (potable or nonpotable) exist within the GMZ of Area 4. Furthermore, it is assumed that the prohibition on the installation of potable water wells will be enforced and groundwater usage within the GMZ would be restricted. This alternative will require the installation of four monitoring wells to a depth of 35 feet and implementation of a groundwater and leachate monitoring program. As part of the monitoring program, six monitoring wells (2 existing, 4 new) will be sampled at predetermined locations in the vicinity of Area 4. The groundwater and leachate

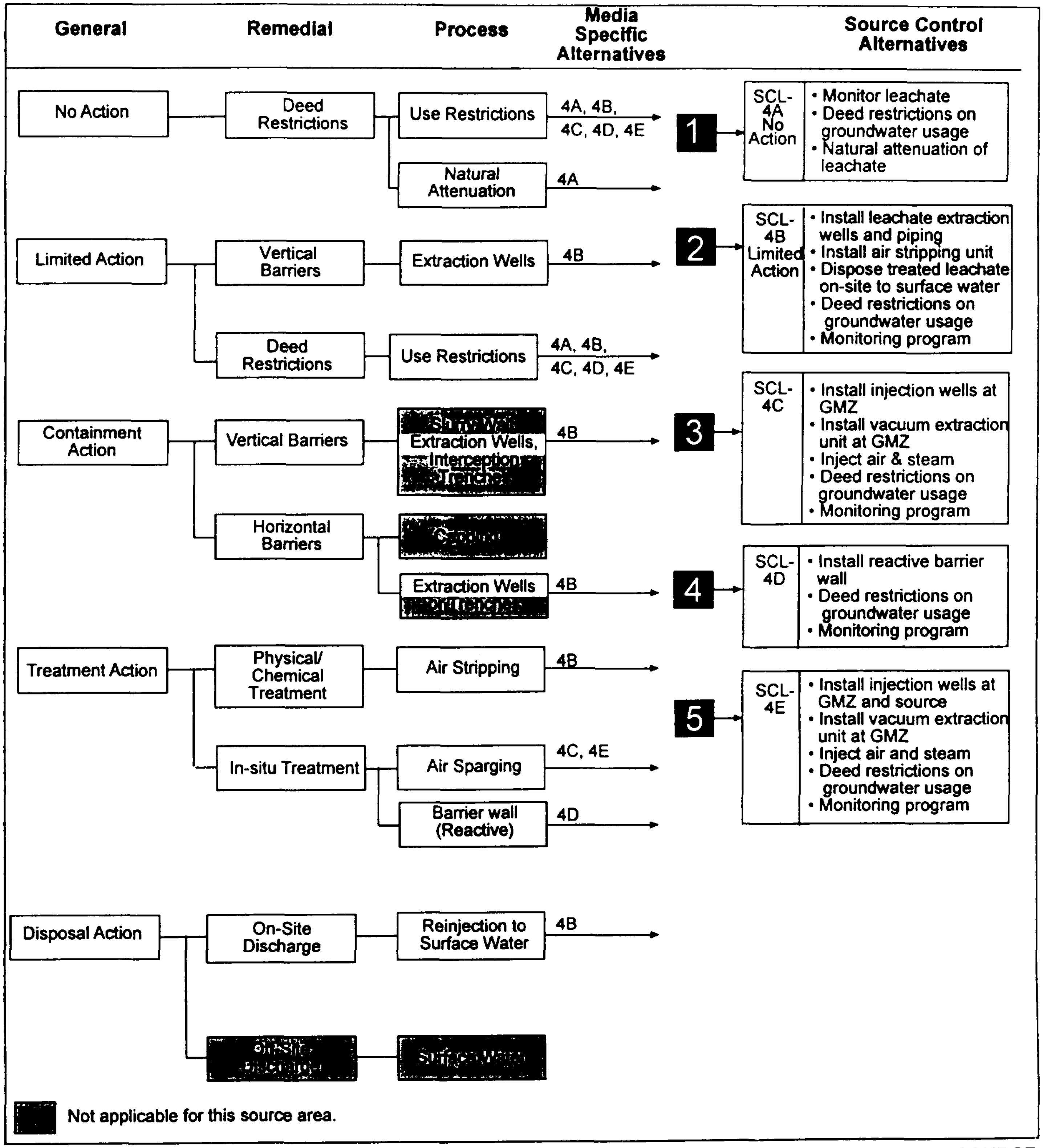

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Figure 5-5
Development of Leachate Source Control Alternatives for Area 4

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would be monitored at predetermined intervals for 30 years (per RCRA post-closure groundwater monitoring requirements).

Effectiveness

For this alternative, assuming no soil source controls, leachate would continue to be generated from the VOC hot spot areas and leach contaminants into the groundwater. The No Action alternative results in a low long-term effectiveness for these reasons. There would be no short-term implementation risks, however, because no remedial activities would occur. The toxicity, mobility, and volume of leachate in the groundwater would not be reduced with this alternative except through natural attenuation mechanisms. Based on the results of the fate and transport analyses, the predicated time to attain ARARs for this alternative is 60 to 70 years (see Section 6).

Implementability

Two monitoring wells would be installed in the vicinity of the source area and two would be installed downgradient. However, no remedial activities would occur. There would likely be regulatory opposition to this source control alternative because the continued migration of contaminants would impact surrounding areas; potential impacts to human health and the environment would not be addressed except through natural attenuation mechanisms, which would require up to 70 years to achieve ARARs at the boundary of the GMZ.

Cost

The cost would be low with this No Action alternative.

As required by the NCP, this alternative is retained for detailed analysis to serve as a basis for relative comparison with other alternatives.

SCL-4B: *Limited Action/Leachate Monitoring/Leachate Collection and Treatment by Air Stripping Unit/Off-site Surface Water Discharge/Groundwater Use Restrictions*

The Limited Action alternative would include installation of a leachate containment system, monitoring of the source area leachate and groundwater, and implementation of groundwater use restrictions. The groundwater and leachate would be monitored in the same manner as stated for Alternative SCL-4A.

As part of the leachate containment system, six leachate extraction wells, piping, controls and an air stripping unit would be installed. The source area leachate would be collected by extraction wells to be installed in the former Swebco facility parking lot. The leachate would be extracted from the extraction wells by submersible pumps and directed to an air stripping unit at a rate of approximately 20 gpm. The collected leachate would be treated by the air stripping unit to acceptable levels. The treated effluent would be discharged on-site to a stormwater ditch located approximately 200 feet north of the source. The effluent would be monitored periodically to confirm that the leachate was treated to acceptable levels.

Effectiveness

This alternative would be slightly more effective in achieving ARARs at the GMZ boundary than the No Action alternative, again assuming no soil source controls as the basis of comparison. This alternative is reasonably effective for controlling groundwater migration through the water-bearing zone via containment/collection/treatment along with groundwater use restrictions, and also reducing the mobility and volume of contaminated groundwater over time. The alternative would restrict groundwater use within the GMZ with long-term effectiveness based on the enforcement of the groundwater use restrictions.

Short-term exposure during implementation would be moderate since minimal contact with leachate would be involved during the installation of the leachate containment system. The long-term exposure would be low, since the majority of the leachate containment system (wells, pumps, and piping) will be enclosed and located in the shallow subsurface.

Implementability

Groundwater and leachate monitoring would be easy to implement. Long-term monitoring of environmental media is a common task that would not require specialized equipment and/or personnel. Also, the leachate containment system installation, including extraction wells, piping, electrical connections, and air stripping unit are common and easily implementable. An issue may be the long-term maintenance of the extraction well pumps and the air stripping unit. Groundwater use restrictions for the source area would not be difficult to implement but would need enforcement for an extended period of time. This alternative would require up to 45 years to achieve ARARs at the boundary of the GMZ.

Cost

The cost of this alternative would be low/moderate.

The Limited Action alternative is retained for detailed analysis because it would be able to meet threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs). Also, this alternative allows for risk protection through groundwater use restrictions and leachate source area remediation.

SCL-4C: Air Sparging along GMZ Boundary/Leachate Monitoring/ Groundwater Use Restrictions

Alternative SCL-4C includes the installation of air injection wells and an air sparging unit. The injection wells would be installed downgradient along the northwestern boundary of the GMZ and screened in the saturated zone. Air would be injected into the subsurface to volatize the contaminant vapors to the vadose zone where they would be removed by vacuum extraction. The vacuum extraction system should be in operation prior to start-up of the sparging wells.

Similar to the previous alternatives, this alternative would also require the installation of leachate and groundwater monitoring wells and implementation of a monitoring program. Groundwater restrictions should also be enforced.

Effectiveness

The air sparging system would be able to achieve ARARs at the GMZ boundary in less time then Limited or No Action. Based on the results of the fate and transport analyses, up to 15 to 25 years to achieve ARARs could be required, based on the assumption of no soil source control. Typically, air sparging systems are able to achieve removal efficiencies of up to 90% in VOC contaminated groundwater. It is likely, however, that the removal efficiency will be lower due to the presence of NAPL. This alternative would be able to reduce contaminant volume and mobility by treating the leachate within the GMZ. Additionally, the air sparging alternative (with soil vapor extraction) for leachate could be integrated with the soil vapor extraction alternative for soil, if selected.

Implementability

Groundwater and leachate monitoring wells would easily be implementable. Long-term monitoring of environmental media is a common task that would not require specialized equipment and/or personnel. Furthermore, the air sparging system, including injection wells, piping, and electrical connections are easily implementable. However, the costs for steam generation and the operation of a steam plant can be extensive and there would be regular operation and maintenance requirements for the air sparging system including pumps, blowers, and electrical and pneumatic connections. Groundwater use restrictions for the source area would not be difficult to implement but would need enforcement for an extended period of time.

Cost

The cost for this alternative would be moderate.

The alternative SCL-4C is retained for detailed analysis because it meets the threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the time required to achieve ARARs is reasonable. Also, this alternative allows for risk protection through groundwater use restrictions and source area leachate remediation.

SCL-4D: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

Alternative SCL-4D would include the installation of a 300-foot reactive barrier wall to an average depth of 60 feet below ground surface downgradient of the source area (on the northwestern boundary of the GMZ). The reactive barrier wall would have a thickness of 2 feet, comprised of a permeable reactive iron media and positioned such that it is able to treat the corresponding leachate plume. As the contaminated leachate moves passively through the treatment wall, the contaminants are removed by sorption onto the iron media. During reactive wall construction, two jetting wells would be installed within the iron media. These jetting wells would allow for rejuvenating the iron media by flushing out solids or biological growth which could foul or clog the reactive wall. Prior to reactive wall design and construction, batch testing would be necessary to evaluate the dimensions of the required in-situ treatment zone, the effects of the process on the inorganic chemistry of the groundwater (in particular the potential for mineral precipitation), and the geotechnical and hydraulic conditions.

Also, included in this alternative is the installation of six additional monitoring wells and implementation of a leachate and groundwater monitoring program. Groundwater and leachate would be monitored similar to the previous alternatives, and groundwater use restrictions would be enforced.

<u>Effectiveness</u>

This alternative would be the most effective in treating the leachate plume located in Area 4 such that the ARARs would be attained at the GMZ boundary in less than 1 year as long as the subsurface hydraulics do not change significantly (see Section 6). Based on CDM's experience, the reactive barrier wall is an effective means in treating and controlling waste streams with halogenated organic chemicals. This alternative would reduce contaminant volume, concentration and mobility. Historically, reactive barrier walls have been able to achieve removal efficiencies of up to 99.9%. The end products of the process are completely dehalogenated and non-toxic compounds.

<u>Implementability</u>

Alternative SCL-4D would be implementable. The site characteristics and geology are amenable to the utilization of the reactive barrier wall technology though the technology to excavate walls to 60 feet are costly. In addition, there are serious geotechnical issues associated with constructing the reactive walls adjacent to existing structures as well as relocating utilities to construct a trench across Marshall Street. In addition, there is limited constructor/staging access. Due to the leachate contaminant characteristics, ARARs can be effectively achieved in-situ using Alternative SCL-4D which would not require special discharge requirements or permitting. However, this alternative would require specialized equipment for reactive barrier wall installation. This alternative would require annual operation and maintenance. The reactive iron media can become fouled, clogged, or unreactive over time. The jetting wells installed within the iron media of the wall would be used to flush out any particulate matter or biological growth that might effect the reactive wall performance.

Cost

The relative cost of this alternative would be high to very high. Although the initial capital costs associated with reactive wall construction and installation is high compared to the previous alternatives, the O&M costs associated with Alternative SCL-4D are lower then Alternative SCL-4C.

The Alternative SCL-4D is retained for detailed analysis because it meets threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the times for achieving ARARs are reasonable. Also, this alternative allows for risk protection through groundwater use restrictions and source area leachate containment and remediation.

SCL-4E: Air Sparging along GMZ Boundary and Source Area/Leachate Monitoring/Groundwater Use Restrictions

Alternative SCL-4E includes the installation of source area and GMZ boundary air injection wells and an air sparging unit. The injection wells would be installed downgradient along the northwestern boundary of the GMZ and within the source area. Air would be injected into the subsurface to volatize the contaminant vapors to the vadose zone where they would be removed by vacuum extraction. The vacuum extraction system should be in operation prior to start-up of the sparging wells.

Similar to the previous alternatives, this alternative would also require the installation of leachate and groundwater monitoring wells and implementation of a monitoring program. Groundwater restrictions should also be enforced.

Effectiveness

Based on the results of the Fate and Transport Analyses (Section 6), the air sparging system would achieve ARARs in up to 20 years at the GMZ boundary. Typically, air sparging systems are able to achieve removal efficiencies of up to 90% in VOC contaminated groundwater. Although the removal efficiency will be lower due to the presence of NAPL, this alternative is a more aggressive treatment option compared to the other alternatives. This alternative would be able to reduce contaminant volume and mobility by treating the leachate within the source area and downgradient of the source at the GMZ. Additionally, the air sparging alternative for leachate would be able to work efficiently with the SVE alternative for soil.

Implementability

Groundwater and leachate monitoring wells would be implementable. Long-term monitoring of environmental media is a common task that would not require specialized equipment and/or personnel. Furthermore, the air sparging system, including injection wells, piping, and electrical connections are implementable, however, the implementability of generating steam maybe difficult. There would be regular operation and maintenance requirements for the air sparging system including pumps, blowers, steam generation and electrical and pneumatic connections. Groundwater use restrictions for the source area would not be difficult to implement but would need enforcement.

Cost

The cost for this alternative would be moderate.

The alternative SCL-4E is retained for detailed analysis because it meets threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the times for achieving ARARs are reasonable. Also, this alternative allows for risk protection through source area leachate remediation.

5.2.3 Source Control Alternatives for Leachate in Source Area 7

This section presents a description and evaluation of leachate source control alternatives for Source Area 7. **Figure 5-6** presents the development of the source control alternatives for this area.

Previous investigations conducted by CDM and the Risk Assessment indicate that the subsurface contains VOC contaminated soil which is contributing unacceptable levels of contaminants to groundwater downgradient of the source area. Based on the subsurface conditions at Source Area 7, a number of potential technologies were eliminated from the development of alternatives. Vertical and horizontal barriers consisting of slurry walls, interceptor trenches, surface caps and trenches were eliminated from further consideration for containment of the leachate. Also, off-site surface water discharge was eliminated, since an on-site surface water discharge point is available (unnamed creek to the north of Area 7).

The reinjection of treated leachate to groundwater and discharge to the Rock River Water Reclamation District (RRWRD) (local WWTP) scenarios were both eliminated. The site characteristics indicate that reinjection of treated leachate on-site is not

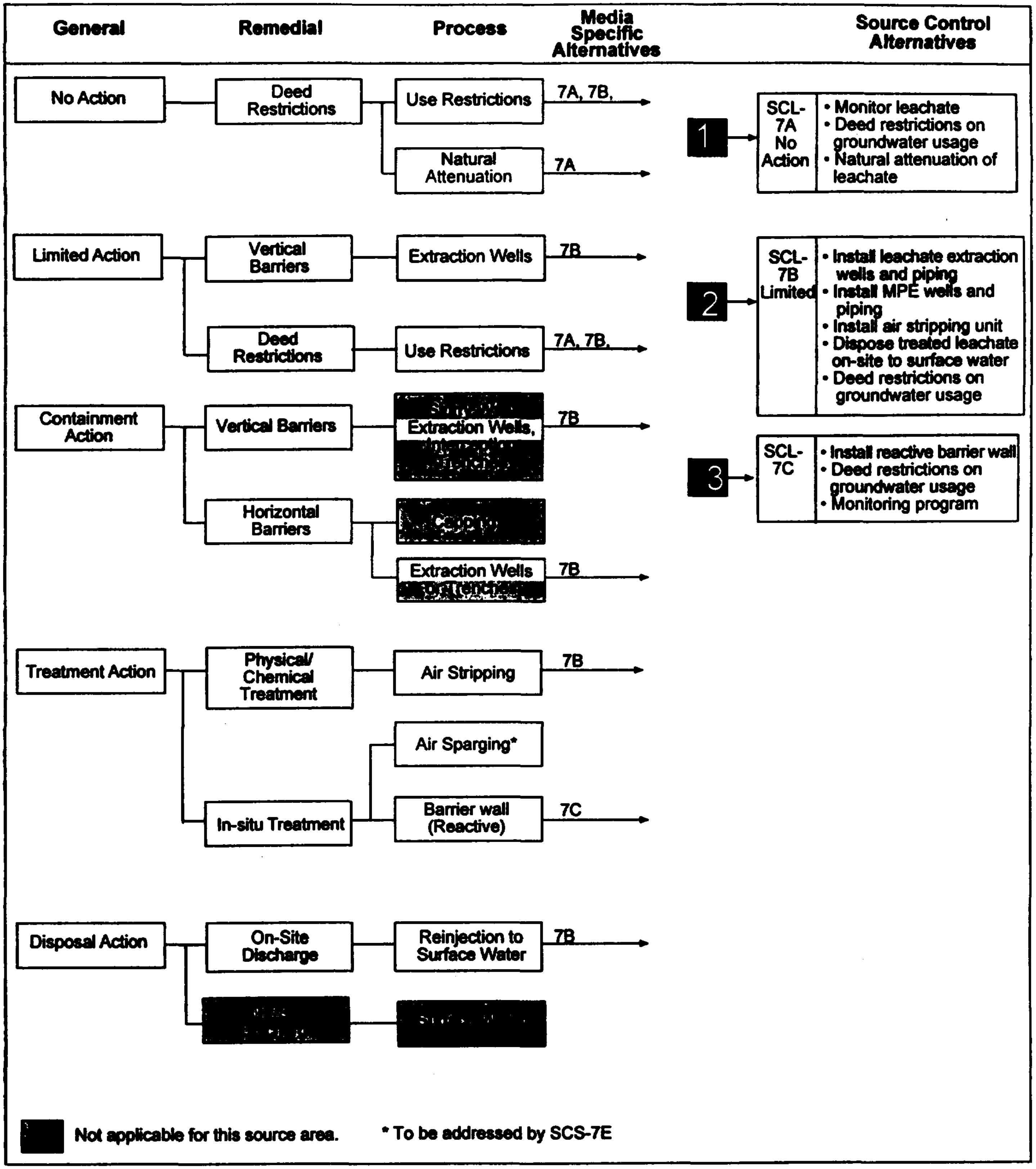

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Figure 5-6
Development of Leachate Source Control Alternatives for Area 7

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feasible. The calculated rate of potential reinjection of treated leachate is much larger than the potential recharge allowance for Area 7. Currently, the RRWRD WWTP is at or near flow capacity. The RRWRD has issued a local ordinance limiting the quantity of environmental remediation wastewater being accepted. If no other feasible option exists for leachate disposal, a formal appeal may be made to the RRWRD to accept leachate. Therefore, the only viable option available is discharge to on-site local surface water (unnamed creek) located 450 feet north of the source area. In order to accomplish discharge on-site, the treated leachate would be required to meet fresh water criteria, a permitted NPDES discharge quality, MCLs, or TACO groundwater remediation objectives.

SCL-7A: ***No Action/Leachate Monitoring/Groundwater Use Restrictions/ Natural Attenuation***

This alternative would consist of no action with leachate monitoring, deed restrictions on groundwater usage and natural attenuation of leachate within Area 7. It is assumed that the prohibition on the installation of potable water wells shall be enforced and groundwater usage within the GMZ would be restricted. This alternative will require the installation of five monitoring wells and implementation of groundwater and leachate monitoring programs. As part of the monitoring program, nine monitoring wells (4 existing and 5 new) would be sampled at predetermined locations in and around Area 7.

Effectiveness

For this alternative and assuming no soil source controls, leachate would continue to be generated from the VOC hot spot areas located in the valley and playground areas and leach contaminants into the groundwater. Due to the shallow depth of contamination, humans and biota could have potential direct contact with the contaminated leachate. The No Action alternative results in a low long-term effectiveness for these reasons. There would be no short-term implementation risks, however, because no remedial activities would occur. The toxicity, mobility, and volume of leachate in the groundwater would not be reduced with this alternative except through natural attenuation mechanisms. Based on the results of the fate and transport analyses, the predicted time to achieve ARARs is 80 to 90 years (see Section 6).

Implementability

Five monitoring wells in and around the source area would be installed. However, no remedial activities would occur. There would likely be regulatory opposition to this source control alternative because the continued migration of contaminants would impact surrounding areas; potential impacts to human health and the environment would not be addressed except through natural attenuation mechanisms.

Cost

The cost would be low with the No Action alternative.

As required by the NCP, this alternative is retained for detailed analysis to serve as a basis for relative comparison with other alternatives.

SCL-7B: ***Multi-Phase Extraction/Collect Leachate and Treat by Air Stripping Unit/Discharge to On-site Surface Water/Groundwater Use Restrictions***

Alternative SCL-7B would include the installation of a multi-phase extraction (MPE) system to be implemented in the source and a leachate containment system to be implemented along the downgradient side of the GMZ. This alternative would also include monitoring of the source area leachate and groundwater, and implementation of groundwater use restrictions. The prohibition on the installation of potable water wells shall be enforced and groundwater usage within the GMZ would be restricted. The groundwater and leachate would be monitored similar to alternative SCL-7A and would occur at predetermined locations in and around Area 7.

This alternative would require the installation of a leachate containment system consisting of eight leachate extraction wells, a central pump station, an air stripping unit, piping, and controls. The source area leachate will be collected via the leachate extraction wells to be located northwest of the park play ground area. The leachate would be collected in the extraction wells and pumped to the air stripping unit at a rate of 10 gpm. The collected leachate would be treated in the air stripping unit and the associated treated effluent would be discharged on-site to the unnamed creek located approximately 450 feet north of the source. Prior to discharging to the creek, the treated effluent would be monitored periodically to confirm that it meets discharge criteria.

This alternative would include the installation of 10 MPE wells in the source to a depth of approximately 25 feet and piped underground to a central vacuum pump/vapor treatment system enclosure. The enclosure would also include an air/water separation system, with the water pumped to the leachate containment system air stripper.

Effectiveness

Based on the results of the Fate and Transport Analyses, this alternative would require up to 40 years to achieve ARARs at the GMZ boundary (see Section 6). This alternative would be effective for controlling groundwater migration through the water-bearing zone via containment/collection and groundwater use restrictions, and also reducing the mobility and volume of contaminated groundwater over time. This alternative would be able to treat the leachate source resulting in a reduction in groundwater contamination and migration. However, the alternative would also restrict groundwater use within the GMZ, with long-term effectiveness based on the enforcement of the groundwater use restrictions.

Short-term exposure during implementation would be moderate since minimal contact with leachate would be involved during the leachate containment system installation. During regular operation and maintenance inspections of the leachate containment system the exposure to leachate would increase slightly. However, the long-term exposure would be low, since the majority of the leachate containment system (wells, pumps, and piping) will be enclosed and located in the shallow subsurface.

Implementability

Groundwater and leachate monitoring would easily be implementable. Long-term monitoring of environmental media is a common task that would not require specialized equipment and/or personnel. Also, the leachate containment system installation, including extraction wells, piping, electrical connections, and an air stripping unit are common and easily implementable. An issue may be the long-term maintenance of the extraction well pumps and the air stripping unit. Groundwater use restrictions for the source area would not be difficult to implement but would need enforcement for an extended period of time.

Cost

The cost of this alternative would be low to moderate.

This alternative is retained for detailed analysis because it meets threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the times for meeting ARARs are reasonable. Also this alternative allows for risk protection through groundwater use restrictions and source area leachate containment and remediation.

SCL-7C: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

Alternative SCL-7C would include the installation of a 2- foot thick reactive barrier wall which would consist of a funnel and gate system. The funnel wall component of the funnel and gate system, due to the site characteristics and hydraulics, would direct the contaminated leachate plume to the reactive treatment wall. The reactive wall would be comprised of a permeable reactive iron media and would be able to treat the corresponding leachate contaminants to acceptable levels. This alternative would include the installation of 10 MPE wells in the source to a depth of approximately 25 feet and piped underground to a central vacuum pump/vapor treatment system enclosure. The enclosure would also include an air/water separation, with the water pumped to the leachate containment system air stripper. During reactive wall construction, two jetting wells would be installed within the iron media. These jetting wells would allow for rejuvenating the iron media by flushing out particulate matter or biological growth which could foul or clog the iron media. Alternative SCL-7C requires the installation of a 310-foot and 420-foot funnel wall located north and west of the source area leachate plume, respectively. The two funnel walls would be joined together with a 210-foot reactive gate positioned between the two walls. The western funnel wall will be tied into bedrock at approximately 50 feet, while the northern funnel wall and reactive gate would be extended to a depth of 80 feet bgs. Prior to reactive wall design and construction, batch testing would be necessary to evaluate the dimension of the required in-situ treatment zone, the effects of the process on the inorganic chemistry of the groundwater (in particular the potential for mineral precipitation), and the geotechnical and hydraulic conditions. The cost for batch testing would be in addition to the cost of the reactive barrier wall material and installation.

Also, included in this alternative is the installation of six monitoring wells and implementation of a leachate and groundwater monitoring program. Groundwater and leachate would be monitored similar to the previous alternatives and groundwater use restrictions enforced.

Effectiveness

This alternative would be effective in treating the leachate plume located in Area 7. ARARs would be attained at the GMZ boundary in less than 1 year as long as the subsurface hydraulics do not change (see Section 6). Based on CDM's experience, the reactive barrier wall would be an effective means in treating and controlling waste streams with halogenated organic chemicals. This alternative would be able to reduce the contaminant volume, concentration and mobility. Historically, reactive barrier walls have been able to achieve removal efficiencies of up to 99.9%. The end products of the process are completely dehalogenated and non-toxic compounds.

The short-term implementation would be difficult during construction activities. The installation procedure would require deep and costly excavation and exposure to contaminated leachate and soil as well as significant geotechnical issues for utility relocation, support of adjacent structures, and work and staging restrictions. The long-term implementations would be relatively easy, since the reactive barrier wall would be located in the subsurface, therefore eliminating risk caused by direct exposure.

Implementability

Alternative SCL-7C would be difficult to implement, but there are several techniques available to install reactive walls at depths greater than 80 feet. The site characteristics and geology are amenable to the reactive barrier wall technology. Due to the leachate contaminant characteristics, ARARs can be effectively achieved when utilizing the barrier wall technology and would not require special discharge requirements or permitting. However, this alternative would require specialized equipment for reactive barrier wall installation and geotechnical/constructability considerations. This alternative would require annual operation and maintenance, as the reactive iron media can become fouled, clogged, or unreactive over time. The jetting wells installed within the iron media of the wall would be used to flush out any particulate matter or biological growth that might effect the reactive wall performance.

Cost

There are minimal O&M costs associated with alternative SCL-7C. However, the initial capital costs associated with reactive wall construction and installation is high compared to the previous alternatives.

The alternative SCL-7C is retained for detailed analysis because it meets threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the times for meeting ARARs are reasonable. Also, this alternative allows for risk protection through groundwater use restrictions and source area leachate remediation.

5.2.4 Source Control Alternatives for Leachate in Source Area 9/10

This section presents a description and evaluation of leachate source control alternatives for Source Area 9/10. **Figure 5-7** presents the development of leachate source control alternatives for Source Area 9/10. It is noted that for Area 9/10, limited data are available due to access restrictions imposed by the property owner during sampling. Additional data must be collected to fully characterize the soil source areas and groundwater contaminant plume prior to full-scale implementation of a remedial alternative.

Area 9/10 contains certain and unknown source areas which are generating contaminated leachate. Based on previous site investigations, elevated concentrations of 1,1-dichloroethene, 1,1,1-trichloroethane and tetrachloroethene were detected in a groundwater monitoring well (MW201) located southwest of the Sundstrand Plant. Due to limited soil and groundwater data available for Area 9/10, additional characterization of this source area will be necessary in the remedial design phase. However, data from a previous investigation conducted at the former Mid-States Industrial property indicates that the source areas appear to be located between the Mid-States Industrial property and MW201. Certain technologies were eliminated based on site-specific constraints for Area 9/10. Vertical and horizontal barriers consisting of slurry walls, interceptor trenches, surface caps and trenches were eliminated from further consideration for containment of the leachate. Also, on-site

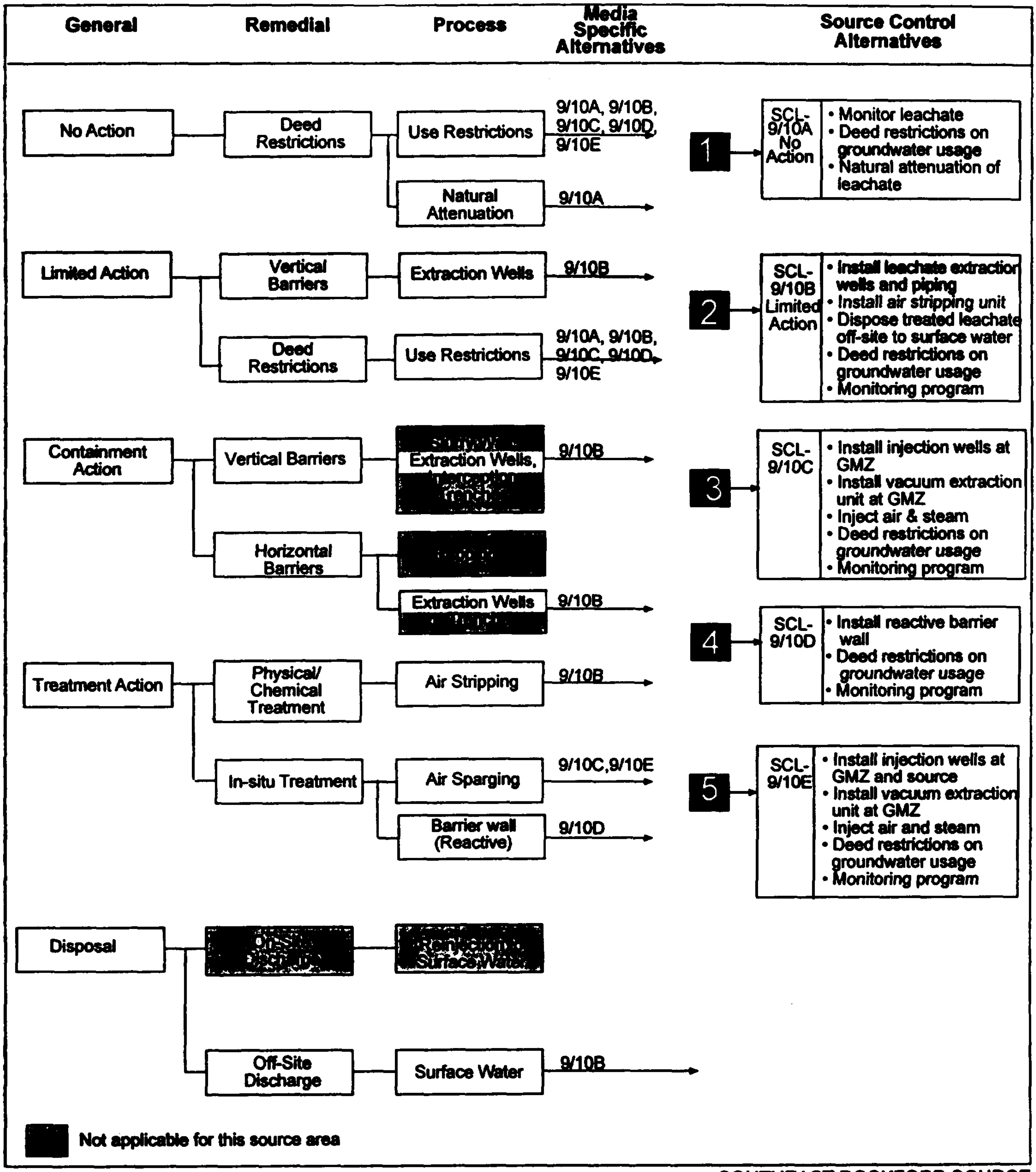

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Figure 5-7
Development of Leachate
Source Control Alternatives for Area 9/10
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surface water discharge was eliminated, since no on-site surface water discharge point was available.

The reinjection of treated leachate to groundwater and discharge to the Rock River Water Reclamation district (local WWTP) scenarios were both eliminated. The site characteristics indicate that reinjection of treated leachate on-site is not feasible. The calculated rate of potential reinjection of treated leachate is much larger than the potential recharge allowance for Area 9/10. Additionally, the Rock River Water Reclamation district is unable to accept waste water from remediation projects due to a local ordinance. Therefore, the only viable option available is discharge to an off-site surface water drainage ditch, located 3,800 feet south of the source area. In order to accomplish discharge off-site, the treated leachate would be required to meet fresh water criteria, a permitted NPDES discharge quality, MCLs, or TACO groundwater remediation objectives.

SCL-9/10A: No Action/Leachate Monitoring/Groundwater Use Restrictions/ Natural Attenuation

This alternative would consist of no action with leachate monitoring, deed restrictions on groundwater usage and natural attenuation of leachate within Area 9/10. It is assumed that the prohibition on the installation of potable water wells shall be enforced and groundwater usage within the GMZ would be restricted. This alternative will require the installation of five monitoring wells and implementation of a groundwater and leachate monitoring program. The groundwater and leachate would be monitored at predetermined intervals for 30 years (per RCRA post-closure groundwater monitoring requirements). Monitoring would occur at predetermined locations in and around Area 9/10.

Effectiveness

For this alternative, leachate would continue to be generated from the VOC contaminated areas located beneath the Sundstrand Plant #1 and leach contaminants into the groundwater. Due to the shallow depth of contamination, humans and biota could have potential direct contact with the contaminated leachate. The No Action alternative results in a low long-term effectiveness for these reasons. There would be no short-term implementation risks, however, because no remedial activities would occur. The toxicity, mobility, and volume of leachate in the groundwater would not be reduced with this alternative except through natural attenuation mechanisms.

Implementability

Five monitoring wells (two in the source area and three downgradient) would be installed. However, no remedial activities would occur. There would likely be regulatory opposition to this source control alternative because the continued migration of contaminants would impact surrounding areas; potential impacts to human health and the environment would not be addressed except through natural attenuation mechanisms which would require many years.

Cost

The cost would be low for the No Action alternative.

As required by the NCP, this alternative is retained for detailed analysis to serve as a basis for relative comparison with other alternatives.

SCL-9/10B: Limited Action/Leachate Collection and Treatment by Air Stripping Unit/Discharge Treated Leachate at Off-site Surface Water/Groundwater Use Restrictions

The Limited Action alternative would include installation of a leachate containment system, monitoring of the source area leachate and groundwater, and implementation of groundwater use restrictions. The groundwater and leachate would be monitored at predetermined intervals for 30 years (per RCRA post-closure groundwater monitoring requirements). Monitoring would occur at predetermined locations in and around Area 9/10.

As part of the leachate containment system, 55 leachate extraction wells, piping, controls and an air stripping unit would be installed. Wells were utilized rather than a deep trench to protect the adjacent building structure. The source area leachate would be collected in leachate extraction wells installed west and south of the Sundstrand Plant #1. The leachate will be extracted from the extraction wells via pumps and sent to the air stripping unit at a rate of 50 gpm. The collected leachate will be treated in the air stripping unit and the associated treated waste stream will be discharged off-site to a stormwater ditch located approximately 2,000 feet south of the source.

Effectiveness

This alternative would be slightly more effective in achieving ARARs at the GMZ boundary than the No Action scenario. This alternative is reasonably effective for controlling groundwater migration through the water-bearing zone via collection and groundwater use restrictions, and also reducing the mobility and volume of contaminated groundwater over time. This alternative would restrict site groundwater use for drinking water, with long-term effectiveness based on the enforcement of the groundwater use restrictions.

Short-term exposure during implementation would be moderate since minimal contact with leachate would be involved during the leachate containment system installation. The long-term exposure would be low, since the majority of the leachate containment system (wells, pumps, and piping) will be enclosed and located in the shallow subsurface.

Implementability

Groundwater and leachate monitoring would be relatively simple to implement, however special construction considerations should be taken in the alley way along the southern edge of the Sundstrand Plant #1 building. Long-term monitoring of environmental media is a common task that would not require specialized equipment and/or personnel. Also, the pump and treat system installation, including extraction wells, piping, electrical connections, and air stripping unit are common and easily implementable. An issue may be the long-term maintenance of the extraction well pumps and the air stripping unit. Groundwater use restrictions for the source area would not be difficult to implement but would need enforcement for an extended period of time.

Cost

The cost of this alternative would be moderate.

The Limited Action alternative is retained for detailed analysis because it meets the threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the time required to achieve ARARs is reasonable. Also this alternative, allows for risk protection through groundwater use restrictions and leachate source area remediation.

SCL-9/10C: Air Sparging along GMZ Boundary/Monitoring/Groundwater Use Restrictions

Alternative SCL-9/10C includes the installation of air injection wells along the southwestern boundary of the GMZ and an air sparging unit. Similar to alternative SCL-4C, injection wells would be installed along the GMZ boundary to contain and treat the source area leachate. Air would be injected into the subsurface to volatize the contaminant vapors to the vadose zone where they would be removed by vacuum extraction.

Similar to the previous alternatives, this alternative would also require the installation of leachate and groundwater monitoring wells and implementation of a monitoring program. Groundwater restrictions should also be enforced.

Effectiveness

The air sparging system would be able to achieve ARARs at the GMZ boundary. Typically, air sparging systems are able to achieve removal efficiencies of up to 90% in VOC contaminated groundwater. This alternative would be able to reduce contaminant volume and mobility by containing and treating the source area leachate. Additionally, the air sparging alternative (with soil vapor extraction) for leachate would be able to work efficiently with the soil vapor extraction alternative for soil, if selected.

Implementability

The construction of groundwater and leachate monitoring wells would be relatively easy to implement. However, special construction considerations should be taken in the alley way along the southern edge of the Sundstrand Plant #1 building and Ninth Street. Long-term monitoring of environmental media is a common task that would not require specialized equipment and/or personnel. Furthermore, the air sparging system, including injection wells, piping, and electrical connections are implementable. However, the costs of steam generation and operation can be expensive and there would be regular operation and maintenance requirements for the air sparging system including pumps, blowers, and electrical and pneumatic connections. Groundwater use restrictions for the source area would not be difficult to implement but would need enforcement for an extended period of time.

Cost

The cost of this alternative would be moderate.

The alternative SCL-9/10C is retained for detailed analysis because it allows for risk protection through groundwater use restrictions and source area leachate remediation. Also, this remedy meets threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the times for meeting ARARs are reasonable.

SCL-9/10D: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

Alternative SCL-9/10D would include the installation of a 50-foot deep funnel and gate reactive barrier wall system downgradient of the source area. Since the depth to the lower confining layer is at great depth and the contaminants are located 30 to 40 feet (bgs), the reactive barrier wall would be a hanging type. Similar to SCL-7C, the reactive wall would be 2-feet thick and be comprised of two funnel walls joined by a reactive wall in the center. A 265-foot funnel wall would be installed to the west and an 600-foot funnel wall to the south of Sundstrand Plant #1. A 200-foot permeable reactive iron media gate will join the two funnel walls. According to site hydraulic characteristics, the funnel and gate system would be able to direct the contaminated leachate to the reactive wall for treatment. During reactive wall construction, two jetting wells would be installed within the iron media. These jetting wells would allow for rejuvenating the iron media by flushing out particulate matter or biological growth which could foul or clog the iron media. Prior to reactive wall design and construction, batch testing would be necessary to evaluate the dimension of the required in-situ treatment zone, the effects of the process on the inorganic chemistry of the groundwater (in particular the potential for mineral precipitation), and the geotechnical and hydraulic conditions. The cost for batch testing would be in addition to the cost of the reactive barrier wall material and installation.

Also included in this alternative is the installation of an additional six monitoring wells and implementation of a leachate and groundwater monitoring program. Groundwater and leachate would be monitored similar to the previous alternatives and groundwater use restrictions enforced.

Effectiveness

This alternative would be effective in treating the leachate plume located in Area 9/10. The ARARs would be immediately attained at the GMZ boundary as long as the subsurface hydraulics do not significantly change. Based on CDM experience, the reactive barrier wall is an effective means in treating and controlling waste streams with halogenated organic chemicals. This alternative would be able to reduce the contaminant volume, concentration and mobility. Historically, reactive barrier walls have been able to achieve removal efficiencies of up to 99.9%.

The short-term implementation would be difficult during construction activities given geotechnical/constructability concerns. The installation procedure would also require excavation and exposure to contaminated leachate and soil. The long-term implementations would be straight-forward, since the reactive barrier wall would be located in the subsurface, therefore eliminating risk caused by direct exposure.

Implementability

This alternative would be relatively simple to implement, however, special construction considerations should be taken in the alley way along the southern edge of the Sundstrand Plant #1 building. The site characteristics and geology are amenable to the reactive barrier wall technology, though costs to excavate to 50 feet are high. In addition, there are geotechnical, utility, and construction access concerns, especially construction a slurry wall adjacent to a city street. Due to the leachate contaminant characteristics, ARARs can be effectively achieved with the barrier wall technology and would not require special discharge requirements or permitting. However, this alternative would require specialized equipment for reactive barrier wall installation as well as detailed construction installation. This alternative would require minimal annual operation and maintenance. The reactive iron media can become fouled, clogged, or unreactive over time. The jetting wells installed within the iron media of the wall would be used to flush out any particulate matter or biological growth that might effect the reactive wall performance.

Cost

The relative cost of this alternative would be high to very high.

There are O&M costs associated with Alternative SCL-9/10D. However, the initial capital costs associated with reactive wall construction and installation is high compared to the previous alternatives.

The Alternative SCL-9/10D is retained for detailed analysis because it allows for risk protection through groundwater use restrictions and source area leachate remediation. Also, this remedy meets threshold criteria (i.e., overall protection of human health and the environment and compliance with ARARs) and the times for meeting ARARs are reasonable.

SCL-9/10E: Air Sparging along GMZ Boundary and the Source Area/Monitoring/ Groundwater Use Restrictions

Alternative SCL-9/10E includes the installation of air injection wells along the southwestern boundary of the GMZ and within the source area, and an air sparging unit. Similar to Alternative SCL-4E, injection wells would be installed along the GMZ boundary and source area to contain and treat the source area leachate. Air would be injected into the subsurface to volatize the contaminant vapors to the vadose zone where they would be removed by vacuum extraction.

Similar to the previous alternatives, this alternative would also require the installation of leachate and groundwater monitoring wells and implementation of a monitoring program. Groundwater restrictions should also be enforced.

Effectiveness

The air sparging system would likely be able to achieve ARARs at the GMZ boundary. Typically, air sparging systems are able to achieve removal efficiencies of up to 90% in VOC contaminated groundwater. This alternative is a more aggressive treatment option compared to the other alternatives. Additionally, the air sparging alternative (with SVE) for leachate would be able to work efficiently with the SVE alternative for soil, if selected.

Implementability

Groundwater and leachate monitoring wells would be relatively simple to implement, however, special construction considerations should be taken in the alley way along the southern edge of the Sundstrand Plant #1 building and Ninth Street. Long-term monitoring of environmental media is a common task that would not require specialized equipment and/or personnel. Furthermore, the air sparging system, including injection wells, piping, and electrical connections are also easily implementable. However, there are steam associated generation and operation issues and there would be regular operation and maintenance requirements for the air sparging system including pumps, blowers, and electrical and pneumatic connections. Groundwater use restrictions for the source area would not be difficult to implement but would need enforcement for an extended period of time.

Cost

The cost of this alternative would be moderate.

The Alternative SCL-9/10E is retained for detailed analysis because it allows for risk protection through groundwater use restrictions and source area leachate remediation. Also, this remedy meets threshold criteria and the times for meeting ARARs are reasonable.

Section 6
Contaminant Fate and Transport

6.1 Introduction

This section describes and presents the results of the contaminant fate and transport analysis conducted for the Focused Feasibility Study (FFS) for the Source Control Operable Unit (SCOU) of the Southeast Rockford Groundwater Contamination Project. The main objective of the fate and transport analysis is to help assess the impact and effectiveness of proposed remedial measures for the soil source areas addressed in this FFS, which include Areas 4, 7, 9/10, and 11. The analysis allows comparison between the remedial alternatives to assess the potential impacts of source control/reduction relative to no action.

The subsections below describe the approach used in the contaminant fate and transport analysis, the limitations of the analysis, and the results of the analysis for the four source areas. Details of input parameters for the fate and transport analysis and computer-generated output are given in Appendix B. In addition, this section will serve as the basis for the establishment of Groundwater Management Zones (GMZs, see Section 3.1) that will be used for leachate remediation. Earlier sections noted that certain ARARs, such as MCLs, are applicable at these GMZ boundaries.

6.2 Methodology of Fate and Transport Analysis

The fate and transport analysis is based on site characterization from previous phases of work, including the Phase I Remedial Investigation (CDM 1992), the Phase II RI (CDM 1995), and the Source Control Operable Unit RI (CDM 1997). Site-specific data were used whenever possible and supplemented with information available in the technical literature. The computer program BIOSCREEN (U.S. EPA 1996) was used to evaluate the distribution and movement of contaminants for the different remedial alternatives.

The BIOSCREEN program is an analytical solute transport model which solves an analytical equation for multi-dimensional transport of a decaying contaminant species. The program was developed by the Air Force Center for Environmental Excellence (AFCEE) in collaboration with U. S. EPA and others. It has the ability to simulate advection, dispersion, adsorption, and degradation with first-order decay. BIOSCREEN is frequently used to simulate remediation of dissolved contaminants through natural attenuation (U.S. EPA 1996; Brady et al. 1998), which is equivalent to the No Action Alternative in this FFS. Model runs predict concentrations along the centerline of the contaminant plume at any distance from the source area, as well as changes in concentration with time. Input parameters for the model are briefly discussed below, followed by the general approach for modeling contaminant fate and transport under the remedial actions proposed in this FFS.

6.2.1 Model Input Parameters

Input parameters for the fate and transport modeling consist of hydrogeologic and geochemical data:

- Hydraulic conductivity and hydraulic gradient. Site-specific values were used
- Effective porosity. Typical values of 0.20 to 0.25 was used, depending on source area
- Longitudinal, transverse, and vertical dispersivity. Values were calculated by BIOSCREEN using published dispersivity relationships and site-specific plume length
- Retardation factor. Calculated by BIOSCREEN from user-specified values for bulk density (1.7 kg/L), fraction of organic carbon (fOC), and organic carbon-water partition coefficient (KOC). Published values for bulk density, fOC, and KOC were used
- First-order decay coefficient. Calculated by BIOSCREEN based on groundwater half-life values from Howard et al. (1991)
- Model area length and width. Source area-specific values were used
- Simulation time. Source area-specific values were used
- Source zone width, thickness, leachate concentration, and soluble mass of contaminant. Source area-specific values were used

Input parameters were generally selected to provide conservative or worst-case results for contaminant travel times and concentrations. It should be noted that the presence of residual non-aqueous phase liquid (NAPL) was accounted for by the input parameter for soluble mass by using contaminant concentrations from soil in the source areas. Soluble mass was estimated using the volume of contaminated soil, bulk density, and an average soil concentration.

A complete listing of input parameters and an explanation of their selection is provided in Appendix B.

6.2.2 Modeling Approach

The remedial alternatives were evaluated by first running the model for the No Action scenario, which is equivalent to natural attenuation. The No Action modeling of the soil source control alternative and the leachate source control alternative assumed No Action for the soil for both scenarios. The No Action simulation provided the amount of time required to achieve ARARs at the "GMZ" boundary down gradient from the source area. Although a GMZ is not defined for the No

Action alternative, the contaminant fate and transport analysis was conducted assuming the existence of a GMZ for the purpose of comparison with other remedial alternatives. If ARARs for leachate were met at the GMZ for the No Action alternative, further fate and transport analysis was not conducted. The GMZ boundaries for the source areas are shown in **Figures 6-1 through 6-4.**

For soil source control alternatives for No Action and Limited Action, it was assumed that no soil source control or leachate control measures were instituted. For the leachate source control alternatives (except SCL-4E and SCL-7B), it was assumed that no soil source reduction occurred. Source control measures for soil were modeled by reducing the soluble mass from No Action by an amount dictated by the specific soil treatment. For example, a removal efficiency of 99 percent was assumed for thermal desorption, and 85 percent for soil vapor extraction. **Table 6-1** lists the mass removal efficiencies used in the fate and transport analysis. Simulations with reduced soluble mass provided estimates for time to reach ARARs at the GMZ boundary for different soil source control alternatives.

Leachate source control alternatives at the GMZ boundary were modeled using the same soluble mass for the No Action soil alternative and applying the removal efficiency (**Table 6-1**) for leachate treatment. For example, time to achieve ARARs for air sparging (removal efficiency of 90 percent) at the GMZ boundary was evaluated by comparing the influent concentration immediately upgradient of the treatment system with the removal efficiency and the ARAR. For TCA, the MCL is 200 ug/L. When the influent TCA concentration dropped below 2,000 ug/L, the effluent concentration would be less than the MCL because the treatment system removes 90% of the contaminants from the leachate. A similar methodology was used to evaluate the air sparging and reactive barrier wall alternatives at the GMZ boundary.

Alternatives SCL-4E and SCL-7B were modeled slightly differently than other leachate control alternatives to account for source reduction in the source areas. Other leachate control alternatives (SCL-4A, -4B, 4C, and -4D; SCL-7A and SCL-7C) do not include source area reduction. Air sparging of leachate in SCL-4E and multi-phase extraction (MPE) in SCL-7B were accounted for by reducing the amount of soluble mass by 40% and 15%, respectively.

6.3 Limitations of Fate and Transport Analysis

The fate and transport results presented below represent predictions of what might happen if the assumptions on which the simulation are based are realized. Factors such as extreme meteorological conditions (drought and flood) and unanticipated pumping cannot be predicted with any precision and therefore were not incorporated in the future simulations. These factors can affect groundwater flow and thereby mass transport. Moreover, the BIOSCREEN model makes the following assumptions: the aquifer and flow field are homogeneous and isotropic; molecular diffusion is minor and can be neglected; and adsorption can be treated with a linear isotherm. The

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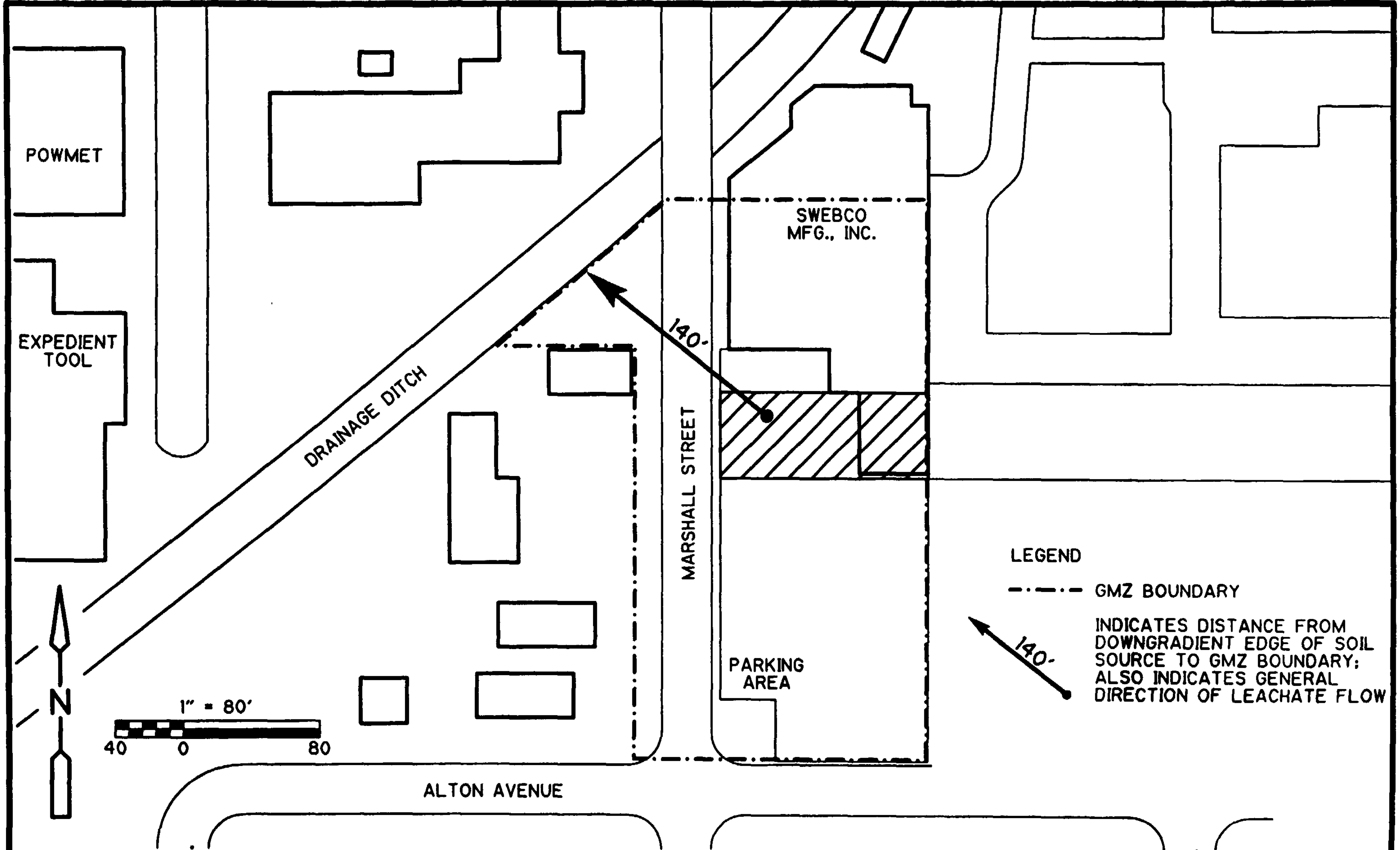

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FIGURE No. 6-1
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

AREA 4 GMZ FOR FATE AND TRANSPORT ANALYSIS

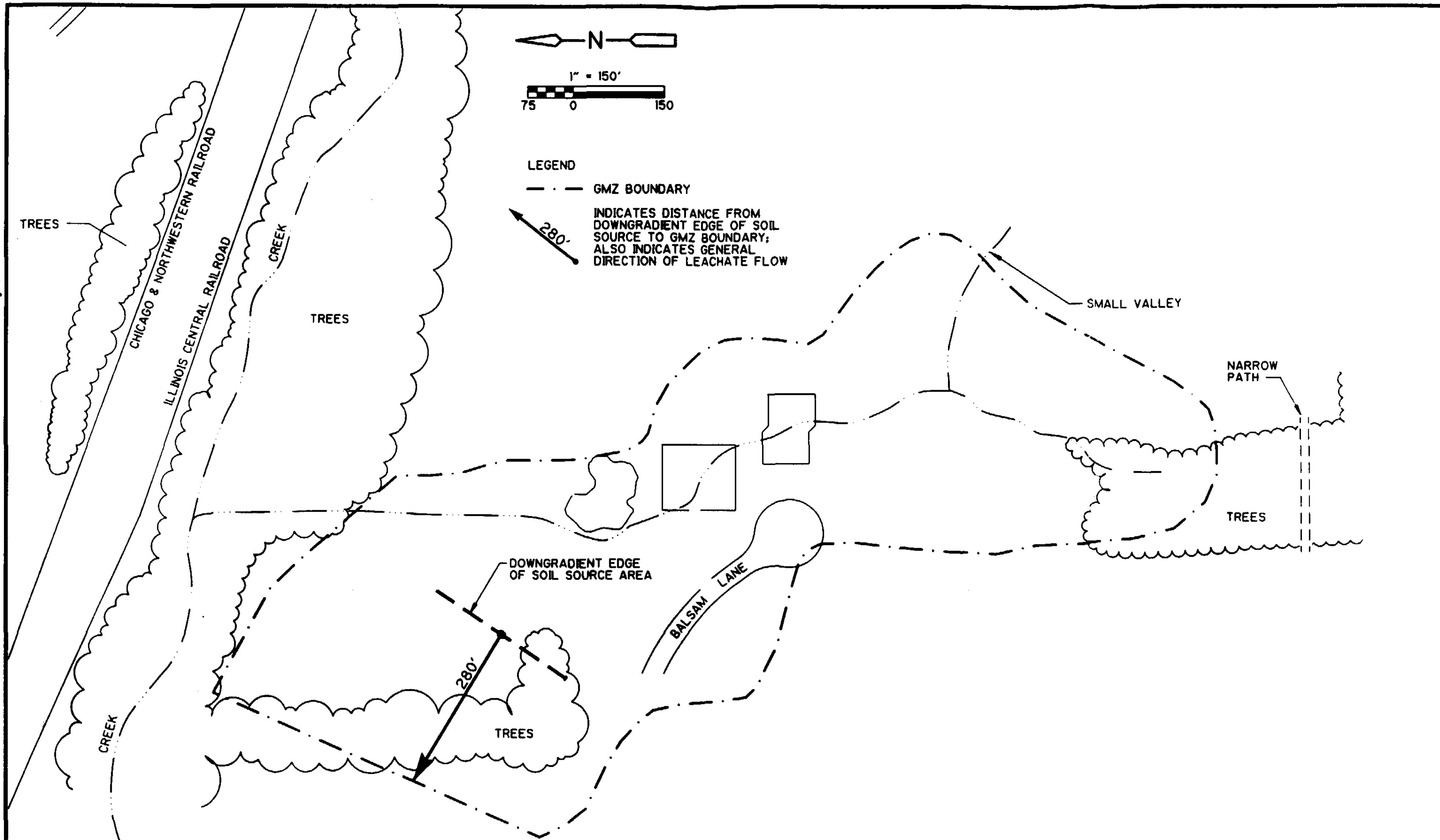

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FIGURE No. 6-2
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

AREA 7 GMZ FOR FATE AND TRANSPORT ANALYSIS

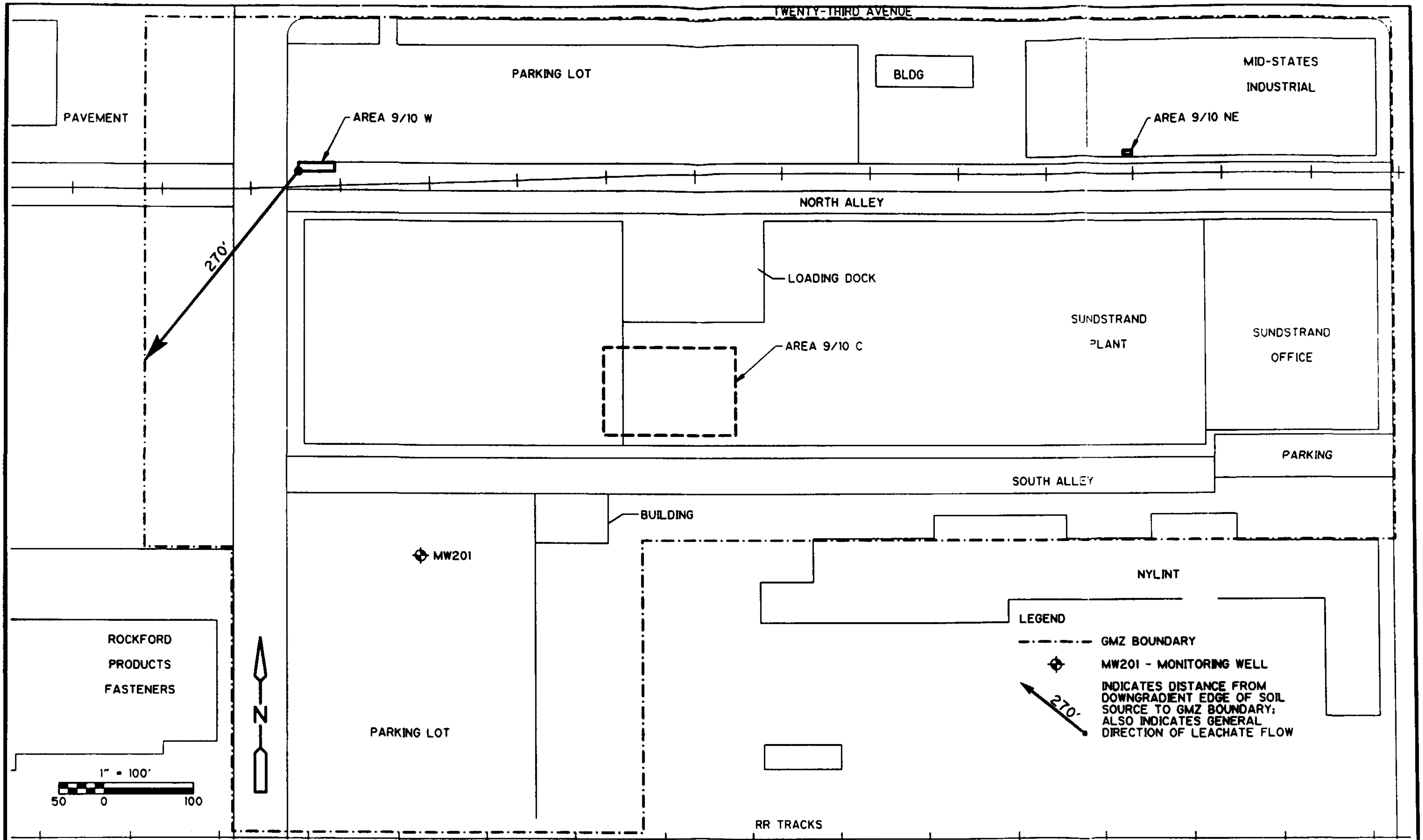

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FIGURE No. 6-3
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

AREA 9/10 GMZ FOR FATE AND TRANSPORT ANALYSIS

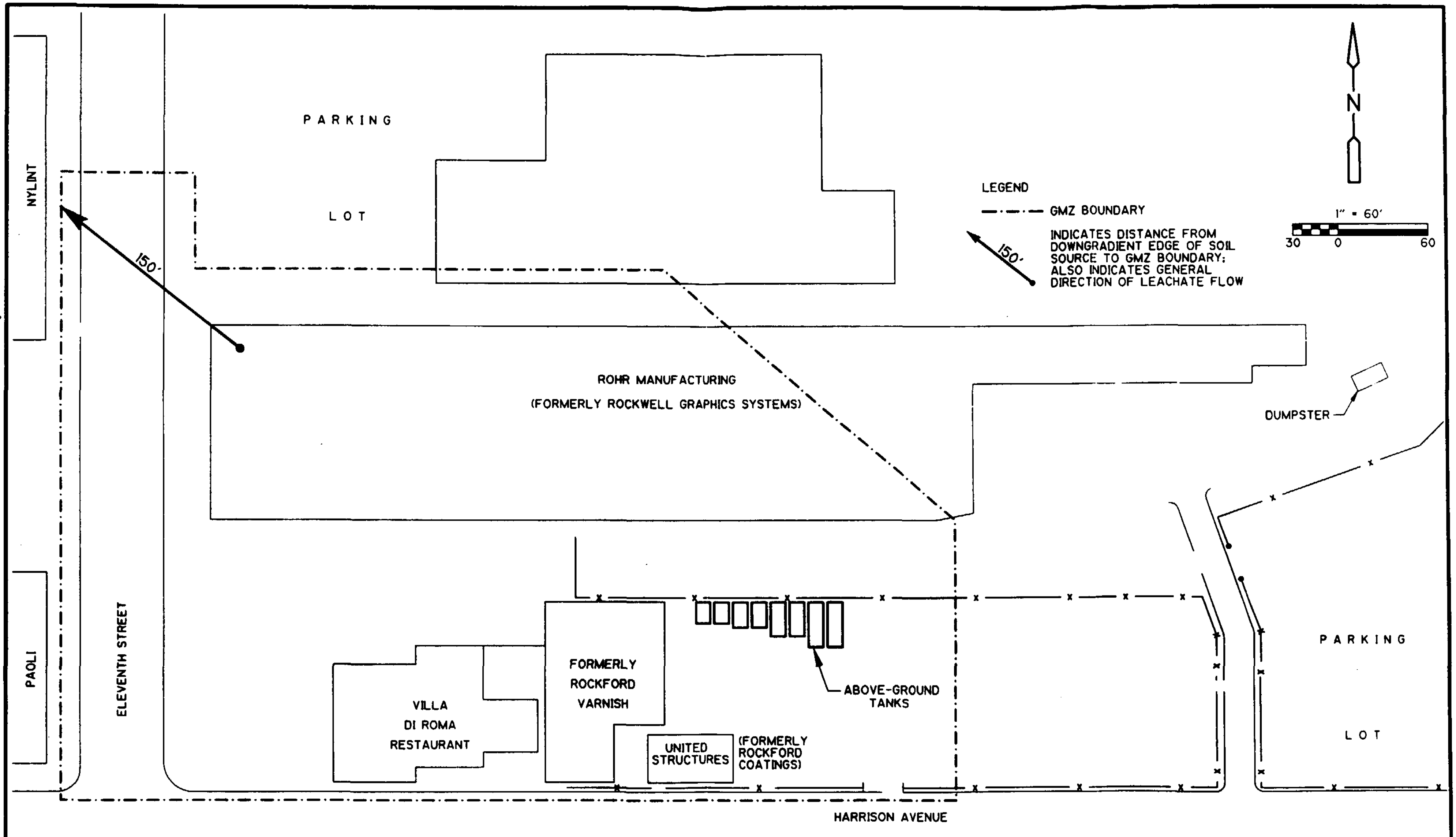

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FIGURE No. 6-4
SOUTHEAST ROCKFORD
SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

AREA 11 GMZ FOR FATE AND TRANSPORT ANALYSIS

Table 6-1

Mass Removal Efficiencies Used in Fate and Transport Analysis

Southeast Rockford Source Control Operable Unit
Focused Feasibility Study
Rockford, Illinois

	Remedial Technology	Mass Removal Efficiency
SOIL		
	Soil Vapor Extraction	85%[a]
	Thermal Desorption	99%[b]
	Excavation and On-site Biopile	90%[a]
	SVE + Air Sparging	95%[a]
	Multi-Phase Extraction	15%
LEACHATE		
	Air Stripping	70%[a]
	Air Sparging	90%[a]
	Reactive Barrier Wall	99.9%[c]
	Multi-Phase Extraction[e]	15%

[a] Based on CDM's experience with this technology and site-specific conditions that may influence treatment efficien

[b] Based on information supplied by thermal treatment vendor E[3] Thermal Remediation Group (Naperville, IL) for Dir Fired Low Temperature Thermal Desorption

[c] From paper by Robert Gillham, *In Situ Remediation of Groundwater Using Granular Iron: Case Studies.* Presented at the International Business Communications Group Second Annual Conference on Innovative Remediation Technologies, July 21 - 23, 1997, Boston, MA

[e] Source Area only

accuracy of the model runs is also subject to the timing of source area removal. Absolute values for time to reach ARARs and future contaminant concentrations should be considered estimates only; however, because the same parameters and assumptions are used in the analysis for each source area, direct comparison among the various remedial alternatives is generally valid for each source area.

6.4 Results of Fate and Transport Analysis

6.4.1 Source Area 4

The results of the fate and transport analysis for Area 4 are summarized in **Table 6-2**, which lists the estimated time required to reach ARARs for the different soil source control (SCS) and source leachate control (SCL) alternatives. The soil and leachate source control alternatives are discussed in detail in Section 5 of this report. The terminology of Section 5 is retained for the fate and transport analysis. The results for SCS-4A (No Action for soil), SCS-4B (Limited Action for soil), and SCL-4A (No Action for leachate) are identical because these alternatives do not include any measures to control either the soil or leachate sources. Alternatives SCS-4C (SVE in soil) and SCS-4D (thermal desorption) reach ARARs more quickly than natural attenuation because the soil source is remediated. ARARs are achieved more quickly with thermal desorption (SCS-4D) than with soil vapor extraction (SVE, Alternative SCS-4C) because of the higher removal efficiency associated with thermal desorption. It should be noted that alternatives SCS-4C and SCS-4D were modeled with the conservative assumption that source leachate concentrations remain constant until soil treatment is completed.

Active leachate control results in decreased time to reach ARARs compared with the No Action alternative (SCL-4A). Air stripping at only the GMZ boundary (SCL-4B) requires the most time to achieve ARARs because of the relatively lower removal efficiency (70%) compared with air sparging (SCL-4C) and reactive barrier wall (SCL-4D). Air sparging at the GMZ only reduces the time to reach ARARs because of the increased removal efficiency relative to air stripping; however, air sparging at both the source area and at the GMZ (SCL-4E) provides additional mass removal, resulting in faster attainment of ARARs. The combination of SVE (SCS-4C) and air sparging (SCL-4C) would result in a time to achieve ARARs of 5-15 years at the GMZ boundary. The reactive barrier wall (SCL-4D) achieves ARARs in the least amount of time because of the significantly higher removal efficiency (99.9%) for this technology.

6.4.2 Source Area 7

The results of the fate and transport analysis for Area 7 are summarized in **Table 6-3**, which lists the estimated time required to reach ARARs for the different soil source control (SCS) and source leachate control (SCL) alternatives. Alternatives SCS-7A (No Action for soil), SCS-7B (Limited Action for soil), and SCL-7A (No Action for leachate) are identical because they do not involve active soil or leachate remediation. For the soil source control alternatives, excavation and on-site biopile (SCS-7C), thermal

Table 6-2

Estimated Time to Reach ARARs for Source Area 4

Southeast Rockford Source Control Operable Unit
Focused Feasibility Study
Rockford, Illinois

	ALT	Action Taken[a] Source Area	GMZ Boundary	Time to Reach ARARs at GMZ (yr)
SOIL				
	SCS-4A	No Action	No Action	60-70
	SCS-4B	Limited Action	None	60-70
	SCS-4C	Soil Vapor Extraction	None	20-30
	SCS-4D	Thermal Desorption	None	5-15
LEACHATE				
	SCL-4A	No Action	No Action	60-70
	SCL-4B	None	Air Stripping	35-45
	SCL-4C	None	Air Sparging	15-25
	SCL-4D	None	Reactive Barrier Wall	<1
	SCL-4E	Air Sparging (Leachate)	Air Sparging	10-20

[a] Soil source control alternatives (SCS) do not entail leachate remediation at the GMZ boundary; leachate control alternatives (SCL) do not entail source reduction, except for SCL-4E

Table 6-3

Estimated Time to Reach ARARs for Source Area 7

Southeast Rockford Source Control Operable Unit
Focused Feasibility Study
Rockford, Illinois

	ALT	Action Taken[a]		Time to Reach ARARs at GMZ (yr)
		Source Area	GMZ Boundary	
SOIL				
	SCS-7A	No Action	No Action	80-90
	SCS-7B	Limited Action	None	80-90
	SCS-7C	*Excavation and On-site* Biopile	None	15-25
	SCS-7D	Thermal Desorption	None	10-20
	SCS-7E	SVE + Air Sparging	None	15-25
LEACHATE				
	SCL-7A	No Action	No Action	80-90
	SCL-7B	Multi-Phase Extraction	Air Stripping	30-40
	SCL-7C	None	Reactive Barrier Wall	<1

[a] Soil source control alternatives (SCS) do not entail leachate remediation at the GMZ boundary; leachate control alternatives (SCL) do not entail source reduction, except for SCL-7B

desorption (SCS-7D), and SVE plus air sparging (SCS-7E) provide similar times to achieve ARARs because of their similar mass removal efficiencies. The soil source control alternatives assume constant leachate concentration during the process of soil treatment.

For the leachate source control alternatives, the fate and transport analysis indicates the reactive barrier wall (SCL-7C) achieves ARARs in less time than the combination of multi-phase extraction (MPE) in the source area and air stripping at the GMZ boundary (SCL-7B).

6.4.3 Source Area 9/10

Three potential source areas for Area 9/10 were included in this FFS, as shown in **Figure 6-3**. In Area 9/10w (outdoor drum storage area for former Sundstrand Plant #2), VOCs including PCE are the primary concern based on available soil data (104E Request). Chemical data for soil and groundwater samples from Area 9/10ne (former Mid-States Industrial property) collected during the SCOU RI (CDM 1999) did not indicate the presence of a soil source area. Area 9/10c corresponds to the loading dock area located in the north central part of Sundstrand Plant #1.

The loading dock area at Plant #1 contained approximately 14 underground storage tanks (USTs) between 1962 and 1987. These USTs held a variety of liquids, including PCE, new TCA, and waste TCA. Also associated with Plant #1 is the Waste Recycling Area (WRA), which is located near the loading dock area. The WRA, which began operation in 1982, recovers TCA from liquid mixtures containing 90% TCA and 10% oil and grease.

Given the contaminant types and corresponding groundwater concentrations at MW201, other source areas beneath or near Sundstrand Plants #1 and #2 probably exist. See the SCOU RI (CDM 1999) for details.

The GMZ boundary shown in **Figure 6-3** was selected based on the general distribution of soil and groundwater contamination found during the SCOU RI (CDM 1999), as well as on the site-specific considerations such as subsurface utilities. For example, the western GMZ boundary was largely determined by the presence of underground utilities that run adjacent to 9th Street.

6.4.4 Source Area 11

The results of the fate and transport analysis for Area 11 indicate that BETX compounds are naturally attenuated before they reach the GMZ located 150 feet down gradient (**Figure 6-4**). For compounds such as benzene, xylene, methylene chloride, and 2-methylphenol natural attenuation appears to reduce the leachate concentrations below ARARs within about 50 feet from the down gradient edge of contaminated soil in Source Area 11. Contaminant fate and transport analysis was not conducted for remedial options other than the No Action alternative because MCLs were met at the GMZ boundary.

Section 7
Detailed Analysis of Remedial Alternatives

7.1 Evaluation Process and Criteria

This section presents a detailed analysis of the remedial alternatives for soil source control, which were developed under the presumptive remedy approach. This section also presents a detailed analysis of the remedial alternatives for source control leachate which were retained from the alternative screening process (section 6). The detailed analysis of the alternatives includes the following steps:

- Further define each alternative with respect to the volumes or areas of contaminated media to be addressed, the technologies to be used, site-specific application of the technologies, and any performance requirements associated with those technologies; and

- Create a summary profile of each alternative, and assess the alternative against the evaluation criteria specified in the NCP.

It is noted that although the soil remedial alternatives will be analyzed independently from the leachate control alternatives, the selection of a soil remedial alternative could have a significant impact on the effectiveness and protectiveness of a leachate control alternative. This is because of the presence of residual NAPL found at Areas 4, 7 and 11. At residual saturation, NAPL has the ability to produce notable contaminant concentrations in the saturated zone for extended periods of time. Even with the implementation of aggressive remedial technologies, NAPL will remain trapped within the heterogeneities of the porous media continuing to "bleed" small, yet often significant contaminant concentrations into groundwater. Only with the complete removal of the native soils containing the NAPL, can aquifer restoration be effectuated.

The detailed screening of leachate alternatives remediation focuses on analyzing combinations of remedial technologies that will either hydraulically contain or treat the shallow groundwater that exists immediately below and in the vicinity of the four primary source areas. As stated previously, for the purposes of this FFS, and this particular analyses, the shallow groundwater that exists immediately below and in the vicinity of the four primary source areas is considered leachate. Groundwater that lies beyond the GMZ of each source area is considered to be part of the site-wide groundwater.

The RA indicated that SVOCs/PAHs are a health risk in surface soil at Source Areas 4, 7, 9/10, and 11. However, since limited SVOC/PAH data exists in these areas, additional sampling would be necessary to evaluate the extent of SVOC/PAH contamination. The need for remedial actions for SVOCs/PAHs would be based on sampling results therefore, SVOCs/PAHs are not addressed in this FFS and VOCs in subsurface soil are the only concern.

The soil source control alternatives that will be analyzed include no action, limited action or institutional controls, vapor extraction, low temperature thermal desorption, and bioremediation. The source control leachate alternatives that will be analyzed include a no action alternative, limited action with hydraulic containment (i.e., pump and treat), air sparging, and reactive barrier alternatives. Institutional controls, including the implementation of land and groundwater use restrictions, will also be a part of the alternatives analyzed during the detailed analysis. For the leachate analyses, all of the alternatives will include implementing long-term environmental monitoring of both the leachate and the site-wide groundwater. Monitoring will typically consist of collecting groundwater and analyzing for VOCs and, where appropriate, parameters which measure biological activity.

The analyses presented herein will focus on the protectiveness, compliance, effectiveness and permanence, and implementability of each alternative with the understanding that complete removal and/or control of the contaminants present is unlikely. The selection of any of the candidate remedial alternatives will therefore be focused on the alternatives' ability (i.e., protectiveness, effectiveness, etc.) to manage the various current and/or future exposure pathways that may or may not exist given the source setting and the expected local area land use(s). This risk management approach to the review and selection of remedial alternatives is consistent will the requirements of the State of Illinois Solid Waste Management Rules and Groundwater Protection Act.

The evaluation criteria for the detailed analysis include seven of the nine criteria specified by the NCP. Two of the nine criteria - Support Agency acceptance and community acceptance - are modifying criteria which may only be assessed following comment on the draft FFS report and the proposed plan, via EPA review and public hearings. Therefore, these two criteria are not considered at this time. The remaining seven criteria are divided into two groups - the threshold criteria and the balancing criteria - which are described below.

7.1.1 Threshold Criteria

The threshold criteria relate to statutory requirements that each alternative must satisfy in order to be eligible for selection. The following criteria will be addressed below.

- Overall protection of Human Health and the Environment
- Compliance with ARARs

Overall Protection of Human Health and the Environment

Alternatives will be assessed to determine whether they can adequately protect human health and the environment, in both the short-term and long-term, from unacceptable risks posed by hazardous substances, pollutants, or contaminants present at the site, by eliminating, reducing, or controlling exposures to levels established during development of remediation goals consistent with 40 CFR 300.430(e)(2)(I). Assessment of an alternative's overall degree of protection of human health and the environment draws on the assessments of other evaluation criteria, especially long-term effectiveness and permanence, short-term effectiveness, and compliance with applicable or relevant and appropriate requirements (ARARs).

The overall protectiveness of an alternative should be evaluated based on whether it achieves adequate protection of human health and the environment, and should describe how site risks posed through each pathway being addressed by the FFS will be eliminated, reduced, or controlled through treatment, engineering, or institutional goals. The evaluation should also consider whether an alternative poses any unacceptable short-term or cross-media impacts.

Compliance with ARARs

The alternatives will be assessed to determine whether they attain ARARs including federal environmental laws and state environmental or facility siting laws, or if they provide grounds for invoking one of the waivers under paragraphs (f)(1)(ii)(C) of 40 CFR 300.430.

For ease of analysis, the following three classifications of ARARs have been considered for the detailed evaluation:

- Chemical-specific ARARs;
- Location-specific ARARs; and
- Action-specific ARARs.

In addition, other criteria, advisories, and guidelines may be considered if appropriate to the evaluation.

7.1.2 Balancing Criteria

The balancing criteria are the technical criteria that are considered during the detailed analysis.

Long-term Effectiveness and Performance

Alternatives will be assessed for the long-term effectiveness and performance they afford, and for the degree of certainty that they will prove successful. Factors that will be considered, as appropriate, include the following:

- Magnitude of residual risk from untreated waste or treatment residuals remaining at the conclusion of the remedial activities. The characteristics of the residuals should be considered to the degree that they remain hazardous, taking into account their volume, toxicity, mobility, and propensity to bioaccumulate; and

- Adequacy and reliability of controls, such as containment systems and institutional controls, that are necessary to manage treatment residuals and untreated waste. This factor addresses in particular, the uncertainties associated with land disposal, with respect to providing long-term protection from residuals; the assessment of the potential need to replace technical components of the alternative, such as a cap, extraction wells or treatment system; and the potential exposure pathways and risks posed should the remedial action need replacement.

Reduction of Toxicity, Mobility or Volume

The degree to which alternatives employ recycling or treatment that reduces the toxicity, mobility, or volume of contamination shall be assessed, including how treatment is used to address the principal threats posed by the site. Factors that shall be considered, as appropriate, include the following:

- The treatment or recycling processes the alternatives employ and the materials that they will treat;

- The amount of hazardous substances, pollutants, or contaminants that will be destroyed, treated or recycled;

- The degree of expected reduction in toxicity, mobility, or volume of the waste due to treatment or recycling, and the specification of which reduction(s) are occurring;

- The type and quantity of residuals that will remain following treatment, considering the persistence, toxicity, mobility, and propensity to bioaccumulate of such hazardous substances and their constituents; and

- The degree to which treatment reduces the inherent hazards posed by principal threats at the site.

Short-term Effectiveness

The short-term impacts of alternatives shall be assessed considering the following:

Short-term risks that might be posed to the community during implementation of an alternative;

- Potential impacts on workers during remedial action and the effectiveness and reliability of protective measures;
- Potential environmental impacts of the remedial action and the effectiveness and reliability of mitigative measures during implementation; and
- Time until protection is achieved.

Implementability

The ease or difficulty of implementing the alternatives shall be assessed by considering the following types of factors as appropriate:

- Technical feasibility, including technical difficulties and unknowns associated with the construction and operation of the technology; the reliability of the technology; the ease with which additional remedial actions may be undertaken; and the degree to which the effectiveness of the remedy may be monitored;
- Administrative feasibility, including activities needed to coordinate with other offices and agencies, and the ability and time required to obtain any necessary approvals and permits from other agencies (for off-site actions); and
- Availability of services and materials, including the availability of adequate off-site treatment, storage capacity, and disposal capacity and services; the availability of necessary equipment and specialists, and provisions to ensure any necessary additional resources; the availability of services and materials; and the availability of prospective technologies.

Cost

The types of costs that will be assessed include the following:

- Capital costs, including both direct and indirect costs;
- Annual operation and maintenance costs (O&M);
- Cost of periodic replacement of system components; and
- Net present value of capital and O&M costs based on a 30-year period.

Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include expenditures for the equipment, labor, and materials necessary to install remedial actions. Indirect costs include expenditures for engineering, financial, and other services that are not part of actual installation activities, but are required to complete the installation of remedial alternatives. A bid contingency of 10 to 15 percent, a scope contingency based on the level of difficulty to implement the alternative, and costs for engineering design and implementation of the alternative were included as indirect costs.

Annual O&M costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. Periodic replacement costs are necessary when the anticipated duration of the remediation exceeds the design life of the system component.

A present worth analysis is used to evaluate expenditures that occur over different time periods, by discounting all future costs to a common base year, usually the current year. A discount rate of seven percent was used for the present worth analysis. This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life. The total present worth costs presented in this section were estimated as accurately as possible, but were prepared for comparative purposes only. The actual costs for each alternative may change upon detailed design and implementation, but the overall cost difference of one alternative relative to another should not vary significantly. The basis for each of the source control and leachate cost estimates presented in this section is provided in Appendix D.

7.2 Detailed Analysis of Source Control Alternatives for Source Area 4

This section includes the detailed analysis of alternatives developed for Source Area 4. As discussed previously, subsurface investigations conducted in this area indicate that the source of soil contamination, primarily TCA, is limited to the area beneath the Swebco Manufacturing parking lot. The results have also shown that elevated concentrations of soil vapor have migrated eastward from the source area and beneath the western portion of Barrett's Trailer Park.

7.2.1 Alternative SCS-4A: No Action

For Alternative SCS-4A, no active measures would be undertaken to control or remediate the soil. Contaminants in soil would remain onsite and the contaminants would not be reduced in volume treated or contained. No use or access restrictions would be imposed. The No Action alternative is used as a basis of comparison of evaluating other proposed remedial alternatives under CERCLA.

Overall Protection of Human Health and the Environment

Alternative SCS-4A would not be protective of human health or the environment because it would not meet the clean-up goals or provide a reliable means of preventing exposure to site contaminants. The source area contamination would not be eliminated, or significantly reduced or controlled. The effects of natural attenuation are expected to be minimal based on the characteristics of contaminants detected in Area 4. Without treatment, contaminants will continue to leach from soils.

Compliance with ARARs

Alternative SCS-4A would not comply with the ARARs for remediating contaminated soils until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms.

Long-term Effectiveness and Permanence

There would be no long-term maintenance or component replacement requirements as part of this alternative. Treatment by means of natural attenuation alone does not offer a reliable degree of protection. Also, the magnitude of residual from untreated source material would be unacceptable.

Reduction of Toxicity, Mobility or Volume through Treatment

Because Alternative SCS-4A would not include any treatment options, it would not reduce the toxicity, mobility or volume of contaminants at the site, other than through natural attenuation mechanisms.

Short-term Effectiveness

Since no action would be undertaken, this alternative would not pose any short-term risk to the community or the environment as a result of remedial activities.

Implementability

Alternative SCS-4A has no actions to implement.

Cost

There are no costs to implement Alternative SCS-4A as shown in **Table 7-1.**

7.2.2 Alternative SCS-4B: Limited Action - Deed Restrictions

Alternative SCS-4B includes placing deed restrictions on the contaminated area. Deed restrictions would be instituted to prevent installation of drinking water wells and future site development within the soil source area.

TABLE 7-1
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 4
ALTERNATIVE SCS-4A: NO-ACTION [1]
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
TOTAL CAPITAL COSTS	**$0**
ANNUAL OPERATING AND MAINTENANCE COSTS	
TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS	
TOTAL REPLACEMENT COSTS	**$0**
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above)	$0
Present Worth Annual O&M Costs	$0
Present Worth Replacement Costs	$0
TOTAL PRESENT WORTH	**$0**

(1) The No Action alternative for Area 4 soils is a true "no-action" - no additional measures, which incur cost, will be taken for this alternative.

Overall Protection of Human Health and the Environment

Alternative SCS-4B would be designed to provide a reduction of the risk to human health by instituting deed restrictions. The restrictions would provide the necessary controls for potential exposure pathways for contaminated soils as well as source leachate. Alternative SCS-4B would not be protective of human health and the environment. The results of the fate and transport analysis conducted within Section 6 of this FFS indicate that the contaminants in soils will continue to impact leachate beneath the site and at the GMZ boundary for approximately 60-70 years.

Compliance with ARARs

Alternative SCS-4B would not comply with ARARs since contaminants would continue to migrate to the leachate and then into site-wide groundwater.

Long-term Effectiveness and Permanence

Alternative SCS-4B would not achieve any level of long-term effectiveness or permanence. Deed restrictions on future site development would have to be enforced over the long-term to be effective.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative SCS-4B would not reduce the toxicity, mobility or volume of contaminants other than through natural attenuation mechanisms. Treatment by means of natural attenuation alone does not offer a reliable degree of protection. Also, the magnitude of residual risk from untreated source material would be unacceptable.

Short-term Effectiveness

Alternative SCS-4B does not provide any level of short-term effectiveness.

Implementability

Deed restrictions would be relatively easy to implement for limiting well installation and future site development.

Cost

The costs to implement Alternative SCS-4B are shown in **Table 7-2**. The total capital costs associated with this alternative are estimated at $28,000. There are no annual operation and maintenance costs associated with the implementation of this alternative.

TABLE 7-2
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 4
ALTERNATIVE SCS-4B: LIMITED ACTION - DEED RESTRICTIONS
COST SUMMARY

Item/Description		Total Cost
CAPITAL COSTS		
	Deed Restrictions (land use)	$25,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$25,000**
	Bid and Scope Contingency (10%)	$2,500
	TOTAL CAPITAL COSTS	**$28,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	None	$0
	TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS		
	None	$0
	TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$28,000
	Present Worth Annual O&M Costs (4)	$0
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$28,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs - N/A for this alternative.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.
N/A for this alternative.

7.2.3 Alternative SCS-4C: Soil Vapor Extraction/Catalytic Oxidation

Under this alternative, contaminated soils would be remediated in situ via a vapor extraction system. This alternative will consist of the installation of a series of wells connected by an underground piping system. A blower will provide the source of negative pressure to extract vapors from the subsurface. Three vacuum extraction wells will be placed in the source area as shown on **Figure 7-1**. The wells will be screened in the vadose zone, where they will remove volatile contaminants from the unsaturated zone as well as some leachate contaminants which are able to diffuse from the surface of the water table. Typically, the extraction wells are constructed of polyvinyl chloride (PVC) material. However, due to the presence of residual NAPL and a possible scenario of air sparging with steam injection as the remedial action for leachate control, it has been assumed that the wells will be constructed of carbon steel.

The spacing of the extraction well system is based on the radius of influence of an individual extraction well. The radius of influence is determined mainly by the ability of vapors to move through the unsaturated soils. For source Area 4, CDM has estimated a radius of influence of 75 feet, however, the most effective method of determining the radius of influence is to perform an in situ air permeability test. Therefore, it would be necessary to conduct a pilot program would be conducted prior to the design and construction of the SVE system.

Given the presence of residual NAPL at this source area, it is expected that significant quantities of contaminated vapors will be extracted. The vapors will be treated with a catalytic oxidation unit. This system employs a catalyst to facilitate the oxidation of the contaminants. As such, catalytic oxidation units operate at much lower temperatures than thermal incineration systems. The catalyst is a precious metal formulation (e.g., platinum or palladium).

Overall Protection of Human Health and the Environment

This alternative would reduce risks to human health and the environment by reducing the mass of contaminants available to leach from soils to groundwater. Since this alternative is conducted in situ, there is minimal disturbance to the community and surrounding area.

Compliance with ARARs

For this alternative, it would take approximately 20 to 30 years to achieve groundwater ARARs at the GMZ boundary, although contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated. The SVE system would be designed and operated to comply with ARARs. The RCRA requirements within 35 IAC 724 for the management of hazardous waste (vapor condensate in a tank or miscellaneous unit) would be met by the SVE system.

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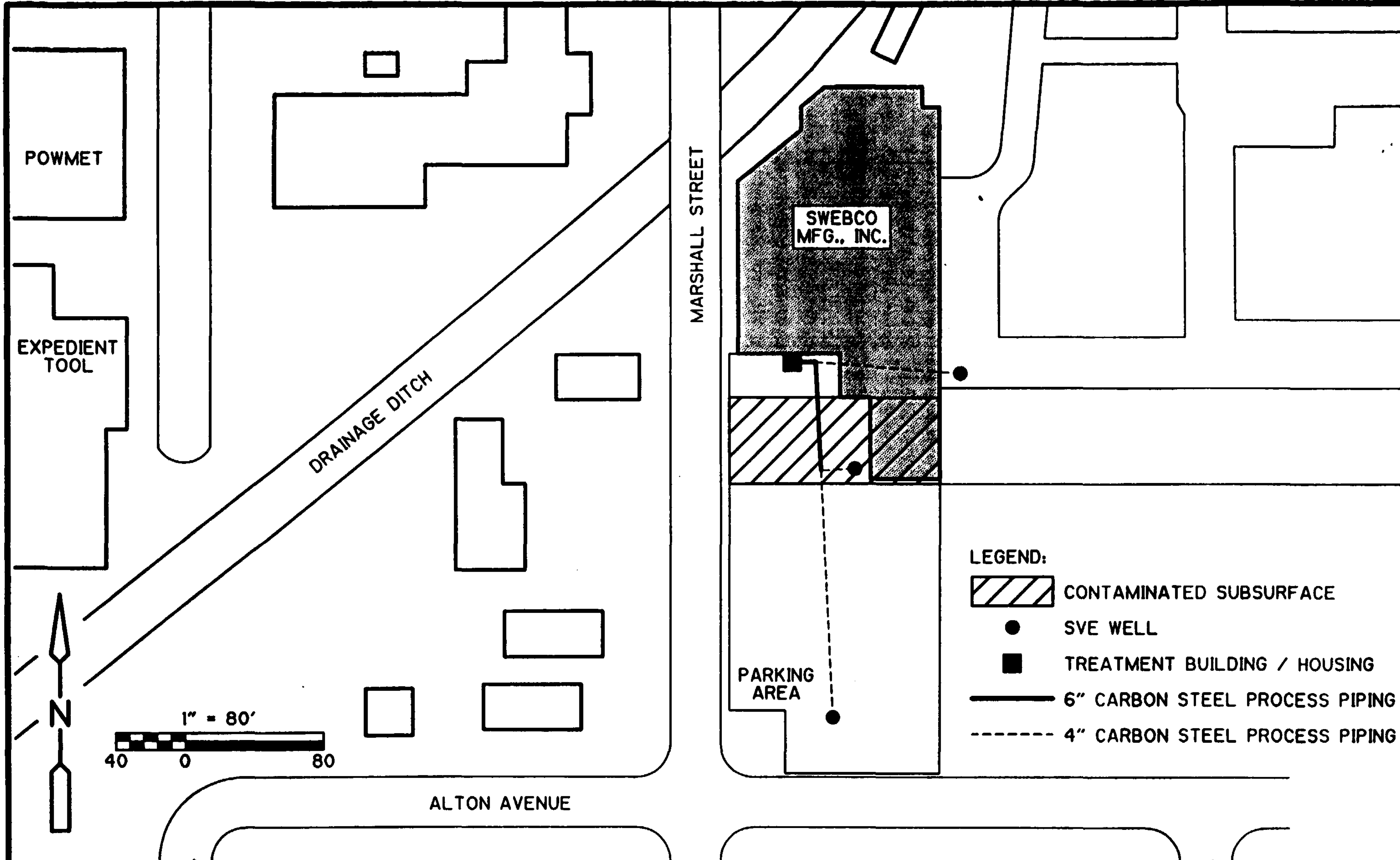

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FIGURE No. 7-1
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 4
SOURCE CONTROL ALTERNATIVE SCS-4C

Additionally, this alternative would comply with RCRA closure and post-closure requirements. Given that residual NAPL has been found at the water table interface, emission controls will be required on the catalytic oxidation unit to ensure compliance with air quality standards.

Long-term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of contaminants to leachate. Vapor extraction is a well-demonstrated technology for the removal of VOCs from soils. Soil contamination left behind after remediation goals have been met will present minimal residual risk due to the reduction in the volume and mobility of the contaminants.

Reduction of Toxicity, Mobility, or Volume through Treatment

Implementation of this alternative could result in a significant reduction of toxicity, mobility and volume of contaminants. Approximately 85% of the contaminant mass is expected to be removed based on CDM's past experience and site specific characteristics. This alternative significantly reduces the inherent hazards posed by the soil source area. However, residual NAPL at the water table interface could provide a continuing source of contaminants to the unsaturated zone and groundwater. Emission controls will be implemented to treat the contaminants removed during the vapor extraction process.

Short-term Effectiveness

Implementation of this alternative will result in minimal risks to on-site workers and the surrounding community during construction. Since the work for this alternative will be conducted in-situ, it is not expected to cause significant exposure for the site workers or the community.

Implementation

This alternative is relatively straightforward to implement and the components of a vapor extraction system are readily available. This technology is widely used in similar applications.

Cost

The costs to implement Alternative SCS-4C are shown in **Table 7-3**. The total capital costs associated with this alternative are estimated at $479,000. Annual operation and maintenance costs are estimated at $135,160. Assuming a discount rate of seven percent, the net present worth of Alternative SCS-4C would be approximately $2,156,000.

TABLE 7-3
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 4
ALTERNATIVE SCS-4C: SOIL VAPOR EXTRACTION (SVE) / CATALYTIC OXIDATION
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
General	$3,000
Soil Vapor Extraction (with emission controls)	$206,000
Catalytic Oxidation System	$134,000
SUBTOTAL CONSTRUCTION COSTS (1)	**$343,000**
Bid Contingency (10%)	$34,000
Scope Contingency (10%)	$34,000
Engineering and Design (15%)	$51,000
Oversight/Health and Safety (5%)	$17,000
TOTAL CAPITAL COSTS	**$479,000**
ANNUAL OPERATING AND MAINTENANCE COSTS	
General	$18,000
Regular System Maintenance/Electrical	$22,000
Catalytic Oxidation System Maintenance	$63,160
Post Treatment Sampling	$32,000
TOTAL ANNUAL COSTS	**$135,160**
REPLACEMENT COSTS	
None	$0
TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$479,000
Present Worth Annual O&M Costs (4)	$1,677,000
Present Worth Replacement Costs	$0
TOTAL PRESENT WORTH	**$2,156,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.

7.2.4 Alternative SCS-4D: Excavation and On-Site Thermal Treatment

Under this alternative, approximately 2,800 cubic yards of contaminated soils would be excavated and VOCs would be removed through on-site thermal treatment via a mobile, direct-fired, low temperature thermal treatment unit. The schematic layout for Alternative SCS-4D is shown on **Figure 7-2**. The backup for contaminated soil volume calculations are provided in **Appendix C**. The majority of the contaminated soil is located below the water table. Therefore, Alternative SCS-4D would include the installation of well points for dewatering at a flow rate of 15 gpm to lower the water table to expose the residual NAPL. The water collected during the dewatering process will be contained on site in two 21,000 gallon carbon steel tanks, and transported to the appropriate disposal facility at a frequency to be determined during the design phase. The soil would then be excavated and stockpiled for processing. Due to the levels of VOCs expected during excavation, the cost to install a temporary enclosure over the excavation for emissions control has been included. Contaminated vapors will be collected and treated on site.

Excavated soils would be screened to remove particles greater than four inches in size and then conveyed to the primary treatment unit where the contaminants are thermally desorbed from the soil. This unit operates at temperatures up to 1,000° F which is sufficient to convert the contaminants in the soil to the vapor phase. The treated soil is then conveyed to a process unit that cools and rehydrates the soil. The soil is stockpiled for testing to ensure that the clean-up goals have been achieved. The production rate of this system ranges from 80 to 120 tons per hour depending on soil type and moisture content. Based on this range, it would take approximately one month to thermally process the soil. The excavation would be backfilled upon completion of treatment of soil to acceptable levels.

The contaminated vapor stream is directed through a bag house to remove particulate matter prior to being introduced to the afterburner. This process unit operates at temperatures between 1,600 °F and 1,800 °F which is sufficient to treat the contaminants to carbon dioxide and water vapor.

Overall Protection of Human Health and the Environment

This alternative would provide both short- and long-term protection as soils with concentrations above the clean-up goals would be excavated and thermally treated. Removing the source would prevent further migration of contaminants to groundwater. Waste volumes would be significantly reduced. Emission control measures would be implemented to minimize exposure of the public and on-site workers to elevated concentrations of VOCs during the excavation, handling and treatment processes.

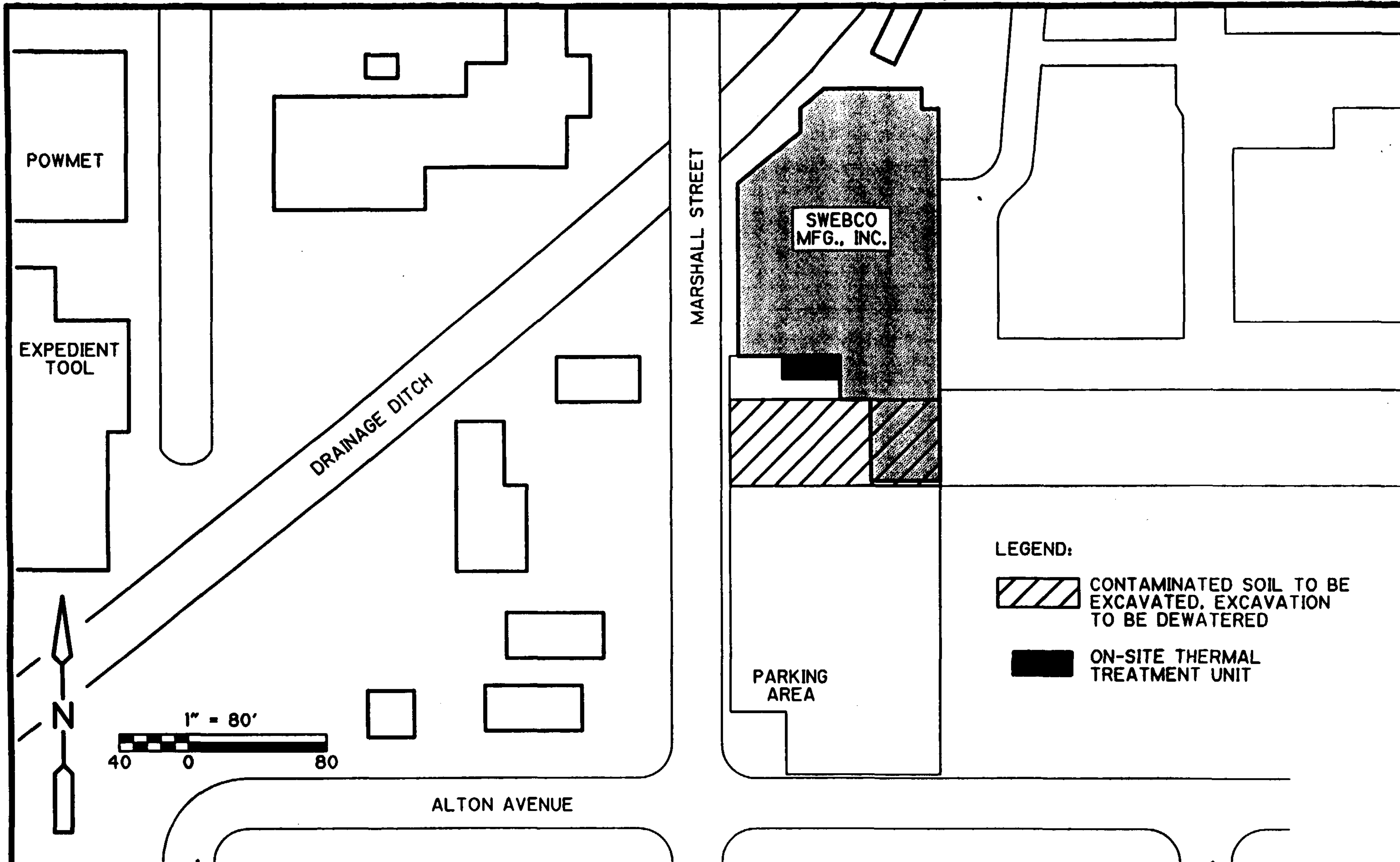

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FIGURE No. 7-2
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 4
SOURCE CONTROL ALTERNATIVE SCS-4D

Compliance with ARARs

Thermal treatment of contaminated soils would be an effective corrective action that would meet soil ARARs. Following removal of contaminated source soils, leachate outside the area of excavation is expected to meet groundwater ARARs at the GMZ boundary in approximately 5 to 15 years. The treatment area would be constructed, operated and maintained according to OSHA requirements and hazardous waste operating requirements. ARARs governing work and community safety would be met.

Long-term Effectiveness and Permanence

This treatment alternative would effectively control the migration of contaminants to source control leachate. This alternative is a well-demonstrated technology for removing VOCs from soils.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative meets the regulatory preference to utilize treatment-based remedies that reduce mobility, toxicity or volume. This treatment alternative would significantly and permanently reduce the mobility, toxicity and volume of the VOCs found in soils. Greater than 90 percent of the contaminated soil source material is expected to be removed through excavation. This alternative significantly reduces the inherent hazards posed by the soil source area.

Short-term Effectiveness

Thermal treatment is effective in reducing risks posed by VOCs in soils. The short-term risks that might be posed to the community during implementation of this alternative are slightly higher than a remedy which does not involve excavation. However, volatile organic compounds released during excavation can be effectively controlled such that there are no adverse impacts to public health. During excavation, on-site workers could be exposed to contaminants through direct contact or inhalation of generated dust. Such exposure would be minimized through the use of protective clothing and equipment and dust suppression procedures. Removal of the soil source material will immediately reduce its contribution to leachate contamination.

Implementability

This treatment alternative is implementable and there are several vendors who are capable of treating contaminated soils using mobile, on-site systems. It is possible that administrative delays could slow project implementation due to the increased technical scrutiny given to thermal treatment units.

Cost

The costs to implement this alternative are itemized in **Table 7-4**. The total capital costs associated with this alternative are estimated at $1,719,000. This alternative will be implemented within one year, therefore there are no annual operation and maintenance costs associated with implementation of this alternative.

7.3 Detailed Analysis of Source Control Alternatives for Source Area 7

This section includes the detailed analysis of alternatives developed for Source Area 7. Both in-situ and excavation and on-site technologies were considered for this source area.

7.3.1 Alternative SCS-7A: No Action

For Alternative SCS-7A, no remedial actions would be undertaken.

Overall Protection of Human Health and the Environment

Alternative SCS-7A would not be protective of human health or the environment because it would not attain ARARs or provide a reliable means of preventing exposure to site contaminants. The source area contamination would not be eliminated, reduced or controlled, except through natural attenuation mechanisms. Contaminants would continue to leach from soils.

Compliance with ARARs

Alternative SCS-7A would not comply with the ARARs for remediating contaminated soils until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms. For this alternative, it would take approximately 80 to 90 years to attain ARARs at the boundary.

Long-term Effectiveness and Permanence

There would be no long-term maintenance or component replacement requirements as part of this alternative.

Reduction of Toxicity, Mobility or Volume through Treatment

Because Alternative SCS-7A would not include any treatment options, it would not reduce the toxicity, mobility or volume of contaminants at the site. As previously discussed, the natural attenuation of chlorinated compounds at this site would be minimal, and any degradation which does occur could produce compounds such as vinyl chloride which is actually higher in toxicity than the parent compounds which currently exist in the soils.

TABLE 7-4
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 4
ALTERNATIVE SCS-4D: EXCAVATION AND ON-SITE THERMAL TREATMENT
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	General	$46,000
	Excavation / On-Site Thermal Treatment	$694,000
	Excavation Dewatering	$397,000
	Post Treatment Sampling	$9,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$1,146,000**
	Bid Contingency (15%)	$172,000
	Scope Contingency (15%)	$172,000
	Engineering and Design (15%)	$172,000
	Oversight/Health and Safety (5%)	$57,000
	TOTAL CAPITAL COSTS	**$1,719,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	General Maintenance of Thermal Treatment System	$0
	TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS		
	TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$1,719,000
	Present Worth Annual O&M Costs (4)	$0
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$1,719,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% annual discount rate over a project life of 2 months.

Short-term Effectiveness

Since no action would be undertaken, this alternative would not pose any short-term risk to the community or the environment as a result of remedial activities.

Implementability

Alternative SCS-7A has no actions to implement.

Cost

There are no costs to implement Alternative SCS-7A as shown in **Table 7-5.**

7.3.2 Alternative SCS-7B: Limited Action - Park Demolition, Access and Deed Restrictions

Alternative SCS-7B includes placing access and deed restrictions on contaminated soils. Physical access restrictions would consist of construction and maintenance of perimeter security fencing and warning sign placement. Deed restrictions would be instituted to prevent future site development. The schematic layout for alternative SCS-7B is shown on **Figure 7-3.**

Overall Protection of Human Health and the Environment

Alternative SCS-7B would be designed to provide a reduction of the risk to human health by instituting access and deed restrictions. The restrictions would provide the necessary controls for potential exposure pathways for contaminated soils as well as source leachate.

Compliance with ARARs

Alternative SCS-7B would not comply with ARARs since contaminants would continue to migrate to the leachate and then into site-wide groundwater. ARARs would not be met at the GMZ boundary for approximately 80 to 90 years.

Long-term Effectiveness and Permanence

Alternative SCS-7B would not achieve any level of long-term effectiveness or permanence. Deed and access restrictions on future site development would have to be enforced over the long-term to be effective.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative would not reduce the mobility, toxicity or volume of contaminants. As previously discussed, the natural attenuation of chlorinated compounds at this site would be minimal, and any degradation which does occur could produce compounds

TABLE 7-5
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 7
ALTERNATIVE SCS-7A: NO-ACTION [1]
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
TOTAL CAPITAL COSTS	**$0**
ANNUAL OPERATING AND MAINTENANCE COSTS	
TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS	
TOTAL REPLACEMENT COSTS	**$0**
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above)	$0
Present Worth Annual O&M Costs	$0
Present Worth Replacement Costs	$0
TOTAL PRESENT WORTH	**$0**

(1) The No Action alternative for Area 7 soils is a true "no-action" - no additional measures, which incur cost, will be taken for this alternative.

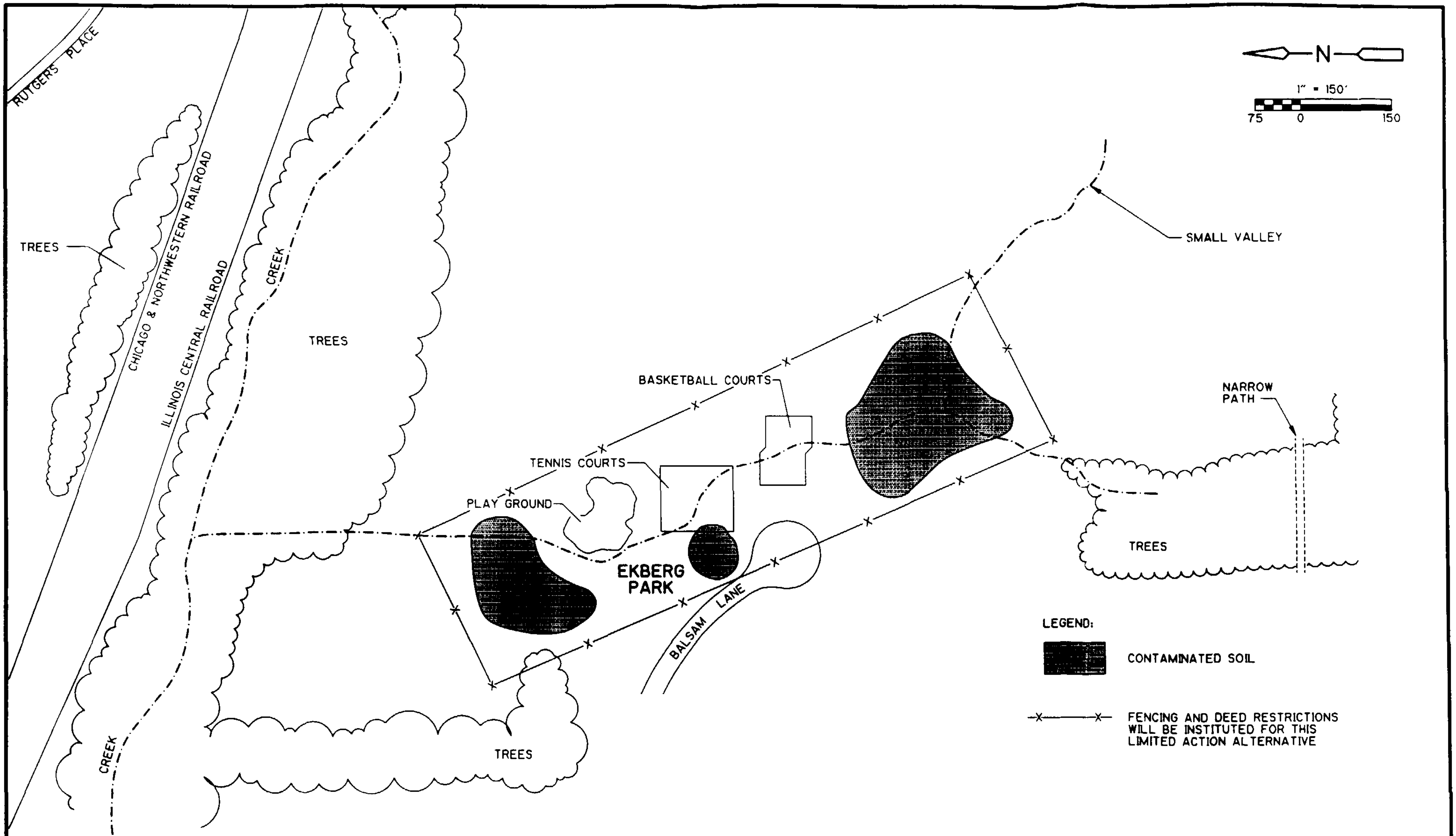

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FIGURE No. 7-3
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 7
SOURCE CONTROL ALTERNATIVE SCS-7B

such as vinyl chloride which is actually higher in toxicity than the parent compounds which currently exist in the soils.

Short-term Effectiveness

Alternative SCS-7B does not provide any level of short-term effectiveness.

Implementability

Deed and access restrictions would be relatively easy to implement for limiting future site development.

Cost

The costs to implement Alternative SCS-7B are shown in **Table 7-6**. The total capital costs associated with this alternative are estimated at $69,000. A replacement cost of $34,000 associated with replacing the fencing and signs has been estimated. Assuming a discount rate of seven percent, the net present worth of this alternative would be approximately $275,000. The schematic layout for alternative SCS-7B is shown on **Figure 7-3**.

7.3.3 Alternative SCS-7C: Excavation and On-site Biological Treatment/Recreational Facilities

Under this alternative, contaminated soils would be excavated and treated on site. Alternative SCS-7C would include dewatering and excavation of approximately 57,000 cubic yards of material for on-site aerobic biotreatment. Although bioremediation is not a presumptive remedy for VOCs in soil, this technology would achieve remediation goals. The schematic layout of Alternative SCS-7C is shown on **Figure 7-4**. The backup for contaminated volume calculations are provided in Appendix C. Alternative SCS-7C would include the installation of well points for dewatering at a flow rate of 10 gpm to lower the water table to expose the residual NAPL. The water collected during the dewatering process will be contained on site in two 21,000 gallon carbon steel tanks, and transported to the appropriate disposal facility at a frequency to be determined during the design phase. The soil would then be excavated and stockpiled for processing. It is likely that most of the volatilization of contaminants will occur during excavation, therefore, the cost to install a temporary enclosure over the excavation has been included. Contaminated vapors will be collected and treated on site. After the contaminated soil is placed in the biopiles, minimal volatilization of the contaminants is expected. Based on the data available, concentrations of contaminants that volatilize from the biopiles will be below standards set forth under the Clean Air Act.

The excavated soil will be screened to remove all particles greater than two inches in size, although slightly larger particle sizes may be allowable. On-site staging areas would be constructed and soils would be piled on high density polyethylene (HDPE)

TABLE 7-6
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 7
ALTERNATIVE SCS-7B: LIMITED ACTION - PARK DEMOLITION, ACCESS AND DEED RESTRICTIONS
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	Access Restrictions (fencing and signs)	$34,000
	Park Demolition	$10,000
	Deed Restrictions (land use)	$25,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$69,000**
	TOTAL CAPITAL COSTS	**$69,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	Signs and Fence Maintenance	$200
	TOTAL ANNUAL COSTS	**$200**
REPLACEMENT COSTS		
	Access Restrictions (fencing and signs) (every 2 years)	$34,000
	TOTAL REPLACEMENT COSTS (2)	**$34,000**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$69,000
	Present Worth Annual O&M Costs (4)	$2,000
	Present Worth Replacement Costs	$204,000
	TOTAL PRESENT WORTH	**$275,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.

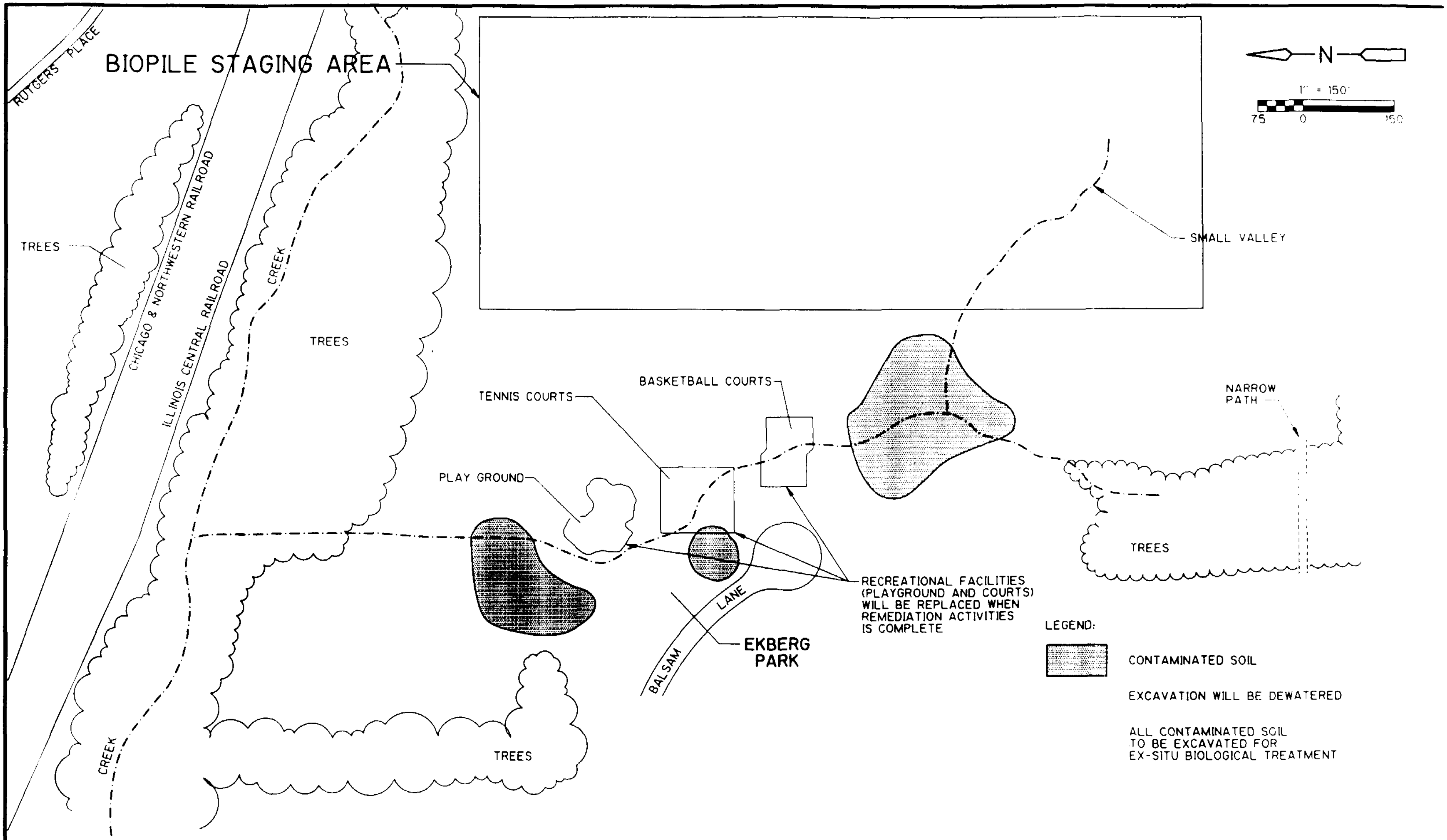

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FIGURE No. 7-4
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 7
SOURCE CONTROL ALTERNATIVE SCS-7C

liners with fine sand layers above and below to maintain liner integrity. The approximate soil pile dimensions would be 6 feet tall with the base of the pile measuring 16 feet across and the top of the pile measuring 5 feet across. Given the large volume of soils to be dewatered and the material processing, it is likely that the biopiles will be set up in stages. If conditions are amenable, however, there is sufficient area to set the piles at one time. The piles would be located in the area shown on **Figure 7-4**. Water and nutrients (i.e., nitrogen and phosphorus) would be added periodically as needed for optimal biological activity. In addition, pH would be controlled by the addition of lime and/or acid. Piping would be installed below the piles within the fine sand layer above the HDPE line. The piping will collect leachate produced by the piles. Following collection, the leachate will be recycled and used for watering the piles as previously described. Mixing would be provided by a mechanical mixer to enhance microorganism/ contaminant interactions and aeration, thereby enhancing biodegradation rates of contaminants. Soils that meet the remedial objectives will be placed back into the excavated areas upon approval by the regulatory agencies. The estimated duration for the treatment of the 57,000 cubic yards of soil is approximately 5 years.

Overall Protection of Human Health and the Environment

This alternative would reduce risks to human health and the environment, since soils with concentrations above the clean-up goals would be excavated and treated to naturally-occurring harmless soil constituents.

Compliance with ARARs

Biopile treatment of soils with mixing would be an effective corrective action that would meet soil ARARs. The treatment area would be constructed, operated and maintained according to OSHA requirements and hazardous waste operating requirements. ARARs governing work and community safety would be met. For leachate, it would take approximately 15 to 25 years to attain ARARs at the GMZ boundary.

Long-term Effectiveness and Permanence

This treatment alternative would effectively control the migration of contaminants to source control leachate. Bioremediation is effective over the long-term as the process will permanently degrade, transform or immobilize the contaminants.

Reduction of Toxicity, Mobility, or Volume through Treatment

This treatment alternative would reduce soil contaminant concentrations to achieve remedial goals. As a result to the extent practical, the toxicity, mobility, and/or volume of contaminated materials would be eliminated or reduced.

Short-term Effectiveness

This treatment alternative would minimize immediate health risks, potentially posed by soil contaminants. During excavation and soil screening, on-site workers could be exposed to contaminants through direct contact or inhalation of generated dust. Such exposure would be minimized through the use of protective clothing and equipment and dust suppression procedures.

Implementability

The treatment process involves using naturally-occurring soil microorganisms to degrade the contaminated soil materials to harmless soil constituents. Biopile treatment with mixing would be easily implemented. The materials and equipment needed to implement this bioremediation process are readily available and the process is relatively straightforward. Implementation would require screening equipment, mobile mixing apparatus, watering devices, and monitoring.

Cost

The costs to implement this alternative are itemized in **Table 7-7**. The total capital costs associated with this alternative are estimated at $15,647,000. Annual operation and maintenance costs are estimated at $627,000. Assuming a discount rate of seven percent, the net present worth of this alternative would be approximately $18,218,000.

7.3.4 Alternative SCS-7D: Contaminated Soils Excavation and On-site Thermal Treatment/Recreational Facilities Replacement

Under this alternative, approximately 57,000 cubic yards of contaminated soils would be excavated for on-site thermal treatment via a mobile, direct-fired, low temperature thermal treatment unit. The schematic layout of Alternative SCS-7D is shown on **Figure 7-5**. A majority of the contaminated soil is located beneath the water table. Therefore, Alternative SCS-7D would include the installation of well points for dewatering at a flow rate of 10 gpm to lower the water table to expose the residual NAPL. The water collected during the dewatering process will be contained on site in two 21,000 gallon carbon steel tanks, and transported to the appropriate disposal facility at a frequency to be determined during the design phase. The soil would then be excavated and stockpiled for processing. Due to the levels of VOCs expected during excavation, the cost to install a temporary enclosure over the excavation has been included. Contaminated vapors will be collected from the enclosure and treated on site.

Excavated soils would be screened to remove particles greater than four inches in size and then conveyed to the primary treatment unit where the contaminants are thermally desorbed from the soil. This unit operates at temperatures up to 1,000 °F which is sufficient to convert the contaminants in the soil to the vapor phase. The

TABLE 7-7
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 7
ALTERNATIVE SCS-7C: EXCAVATION AND ON-SITE BIOLOGICAL TREATMENT/
RECREATIONAL FACILITIES REPLACEMENT
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	General	$35,000
	Excavatoin and On-Site Biological Treatment	$4,574,000
	Excavation Dewatering	$5,396,000
	Recreational Facilities Replacement	$90,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$10,095,000**
	Bid Contingency (15%)	$1,514,000
	Scope Contingency (20%)	$2,019,000
	Engineering and Design (15%)	$1,514,000
	Oversight/Health and Safety (5%)	$505,000
	TOTAL CAPITAL COSTS	**$15,647,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	General	$6,000
	Fence Maintenance	$200
	Post Treatment Sampling	$621,000
	TOTAL ANNUAL COSTS	**$627,000**
REPLACEMENT COSTS		
	TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$15,647,000
	Present Worth Annual O&M Costs (4)	$2,571,000
	Present Worth Replacement Costs (5)	$0
	TOTAL PRESENT WORTH	**$18,218,000**

(1) Capital costs for constemation items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 5 years.

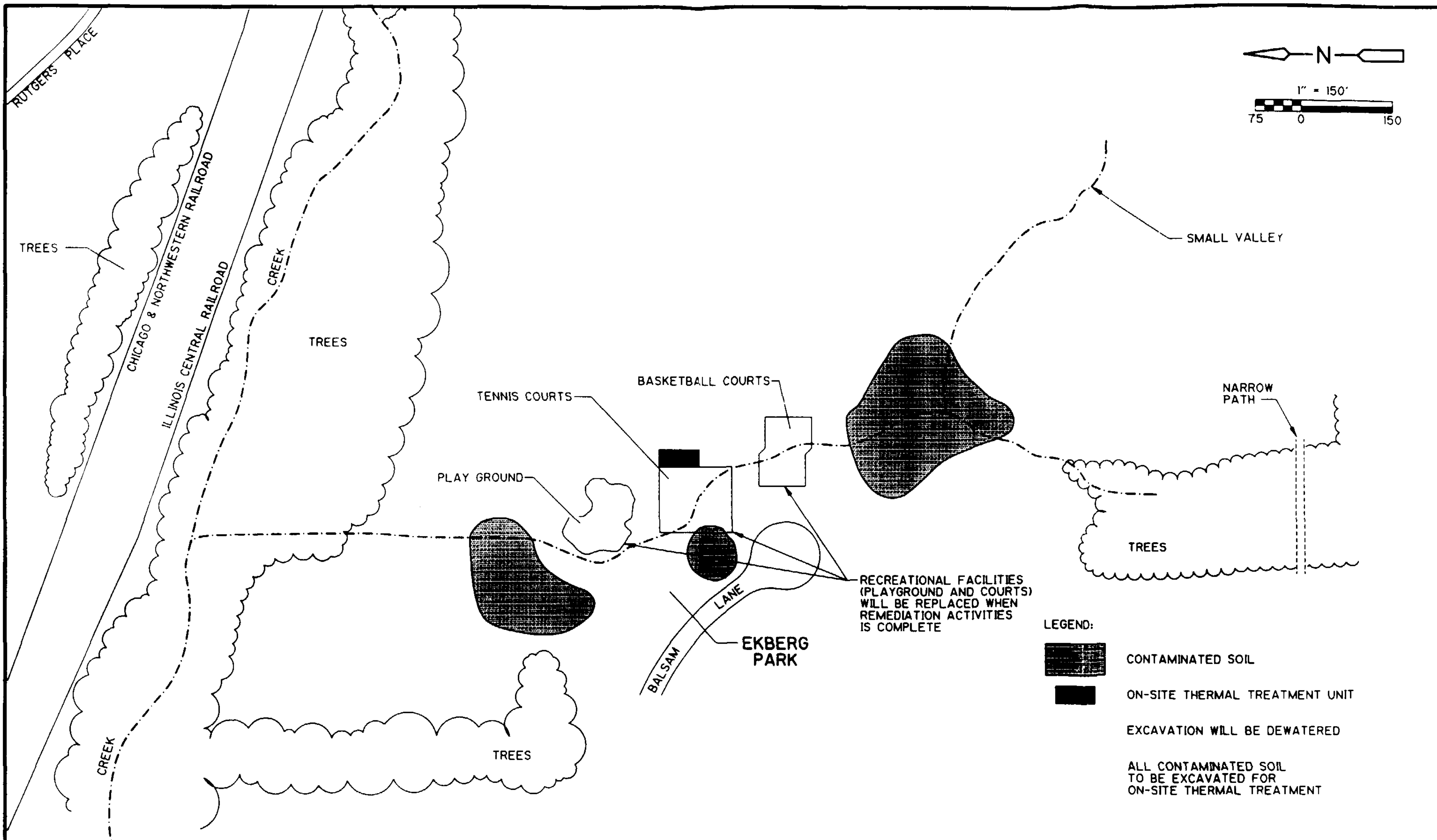

FIGURE No. 7-5
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 7
SOURCE CONTROL ALTERNATIVE SCS-7D

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S:\1681\1110\RLEVL\ A-71therm 05/10/00 15:34:57 1:16:21 Seligarb treated soil is then conveyed to a process unit that cools and rehydrates the soil. The soil is stockpiled for testing to ensure that the ARARs have been achieved. The production rate of this system ranges from 80 to 120 tons per hour depending on soil type and moisture content. Based on this rate, the estimated duration of the thermal treatment is eight months.

The contaminated vapor stream is directed through a bag house to remove particulate matter prior to being introduced to the afterburner. This process unit operates at temperatures between 1,600 °F and 1,800 °F which is sufficient to treat the contaminants to carbon dioxide and water vapor.

Overall Protection of Human Health and the Environment

This alternative would provide both short- and long-term protection as soils with concentrations above the clean-up goals would be excavated and thermally treated. Removing the source would prevent further migration of contaminants to groundwater. Waste volumes would be significantly reduced. Emission control measures would be implemented to minimize exposure of the public and on-site workers to elevated concentrations of VOCs during the excavation, handling and treatment processes.

Compliance with ARARs

Thermal treatment of contaminated soils would be an effective corrective action that would meet soil ARARs. The treatment area would be constructed, operated and maintained according to OSHA requirements and hazardous waste operating requirements. ARARs governing work and community safety would be met. For leachate it would take approximately 10 to 15 years to achieve ARARs at the GMZ boundary.

Long-term Effectiveness and Permanence

This treatment alternative would effectively control the migration of contaminants from soil to source control leachate. This alternative is a well-demonstrated technology for removing VOCs from soils.

Reduction of Toxicity, Mobility, or Volume through Treatment

This alternative meets the regulatory preference to utilize treatment-based remedies that reduce mobility, toxicity or volume. This treatment alternative would significantly and permanently reduce the mobility, toxicity and volume of the VOCs found in soils.

Short-term Effectiveness

Thermal treatment is effective in reducing risks posed by VOCs in soils. Volatile organic compounds released during excavation can be effectively controlled such that there are no adverse impacts to public health. During excavation, on-site workers could be exposed to contaminants through direct contact or inhalation of generated dust. Such exposure would be minimized through the use of protective clothing and equipment and dust suppression procedures. This anticipated duration to treat soils under this alternative would be less than 1 year.

Implementability

This treatment alternative is implementable and there are several vendors who are capable of treating contaminated soils using mobile, on-site systems. It is possible that there may be delays associated with administratively implementing this technology. Excavation of soil below water table would be more complex as this material would require dewatering prior to thermal treatment.

Cost

The costs to implement this alternative are itemized in **Table 7-8**. The total capital costs associated with this alternative are estimated at $15,124,000. An annual operation and maintenance cost of $85,000 associated with general maintenance of the thermal treatment system has been estimated. Assuming a discount rate of seven percent, the net present worth of this alternative would be approximately $15,209,000.

7.3.5 Alternative SCS-7E: Soil Vapor Extraction/Air Sparging along Source Area/Monitoring/Groundwater Use Restrictions/ Catalytic Oxidation

This alternative would combine soil vapor extraction and air sparging technologies to address contaminants in unsaturated and saturated soil and leachate in Source Area 7.

Under this alternative, unsaturated and saturated contaminated soils would be remediated in situ via a vapor extraction system. This alternative will consist of the installation of a series of wells connected by an underground piping system. A blower will provide the source of negative pressure to extract vapors from the subsurface. Sixteen vacuum extraction wells will be placed in the suspected source areas. The wells will be constructed to a depth of up to 25 feet and screened in the vadose zone, where they will extract volatile contaminants from the unsaturated zone as well as some leachate contaminants, which are able to volatilize from the surface of the water table. The estimated flow rate for the SVE system is 1200 standard cubic feet per minute (scfm).

The spacing of the extraction well system is based on the radius of influence of an individual extraction well. The radius of influence is determined mainly by the ability of vapors to move through the unsaturated soils. For this area, CDM has estimated a radius of influence of 75 feet, however, the most effective method of determining the radius of influence and flow rate is to perform an in situ air permeability test. Therefore a pilot program would be conducted prior to the design and construction of the SVE system.

The air sparge system would be constructed to volatilize VOCs from saturated soils and leachate through the injection of air. The VOCs would be collected using vapor extraction wells. A total of 57 air sparge wells would be constructed to a depth of 50 feet below ground surface. CDM has assumed a radius of influence of 25 feet for the air sparging wells. Two air compressors would be used to inject air to the subsurface, each at a rate of 400 scfm, for a total of 800 scfm. However, a pilot study would be conducted to verify flow rate and the radius of influence prior to full-scale implementation. A schematic showing the alternative, including the proposed locations for the vapor extraction and sparge wells, is presented in **Figure 7-6.**

Given the presence of residual NAPL, it is expected that significant concentrations of contaminated vapors will be extracted. The extracted vapors will be treated with a catalytic oxidation unit. Catalytic oxidation is used to treat vapor streams that do not have a high fuel value. The presence of a catalyst allows for thermal treatment of vapors at a significantly lower temperature than systems that do not use a catalyst. The result is lower operational costs due to a lower amount of auxiliary fuel such as natural gas. Carbon adsorption would not be a cost-effective technology for treating the vapor upon startup of the soil vapor extraction systems. However, it is noted that carbon adsorption could be used to address contaminants in the vapor after contaminant concentration levels were reduced using catalytic oxidation for a period of up to six months to one year. Costs for using a combination of catalytic oxidation and carbon adsorption as part of this alternative are presented in **Appendix D.**

Monitoring will be required during system operation to maintain air quality permitting compliance and to evaluate treatment system efficiency. System monitoring will include VOCs only.

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring along the margins of the GMZ to assure that ARARs are being met at the edge of the GMZ.

As with the No Action alternative, groundwater monitoring would be implemented by installing five additional monitoring wells - two within the GMZ and three downgradient of the GMZ - as shown on **Figure 7-6.** These wells, along with two additional downgradient wells, will be sampled for VOCs based on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

TABLE 7-8
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 7
ALTERNATIVE ~~SCS~~-7D: CONTAMINATED SOILS EXCAVATION AND ON-SITE THERMAL TREATMENT / RECREATIONAL FACILITIES REPLACEMENT
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	General	$36,000
	Contaminated Soils Excavation / On-Site Thermal Treatment	$6,683,000
	Excavation Dewatering	$4,029,000
	Recreational Facilities Replacement	$90,000
	Post Treatment Sampling	$366,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$11,204,000**
	Bid Contingency (10%)	$1,120,000
	Scope Contingency (10%)	$1,120,000
	Engineering and Design (10%)	$1,120,000
	Oversight/Health and Safety (5%)	$560,000
	TOTAL CAPITAL COSTS	**$15,124,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	General	$65,000
	General Maintenance of Thermal Treatment System	$20,000
	TOTAL ANNUAL COSTS	**$85,000**
REPLACEMENT COSTS		
	TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$15,124,000
	Present Worth Annual O&M Costs (4)	$85,000
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$15,209,000**

(1) Capital costs for contstruction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a project life of 8 months.

It is assumed that the SVE and air sparging systems will be operated over a period of 10 years.

Overall Protection of Human Health and the Environment

This alternative would reduce risks to human health and the environment by reducing the mass of contaminants available to leach from soils to groundwater. This alternative would also reduce concentrations of contaminants in saturated soil and leachate.

Compliance with ARARs

This alternative would comply with soil ARARs in 15 to 25 years given that contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated. Emission controls will be required to ensure compliance with air quality standards. There is the potential for the formation of dioxins during catalytic oxidation treatment. However, levels of dioxins would be very low and well below any unacceptable risk levels.

Long-term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of contaminants to leachate. Concentrations of contaminants in saturated soil and leachate would also be reduced.

This alternative offers some long-term effectiveness and permanence for controlling the migration of leachate from the GMZ into site-wide groundwater. The air sparge technology can be operated reliably over long periods of time and it can reduce leachate contaminant concentrations in the areas where it operates. The air sparge system will partially control the migration of leachate from the GMZ into site-wide groundwater. Therefore, this treatment system does offer moderate long-term effectiveness in meeting the RAOs.

Note that institutional controls, which are a component of this alternative, will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, or Volume through Treatment

Implementation of this alternative could result in a significant reduction of toxicity, mobility and volume of contaminants. Emission controls will be implemented to treat the contaminants removed during the vapor extraction process. Most catalytic units are capable of more than 99 percent removal of chlorinated solvents and with the contaminants at Source Area 7, there is little potential to form dioxins during treatment.

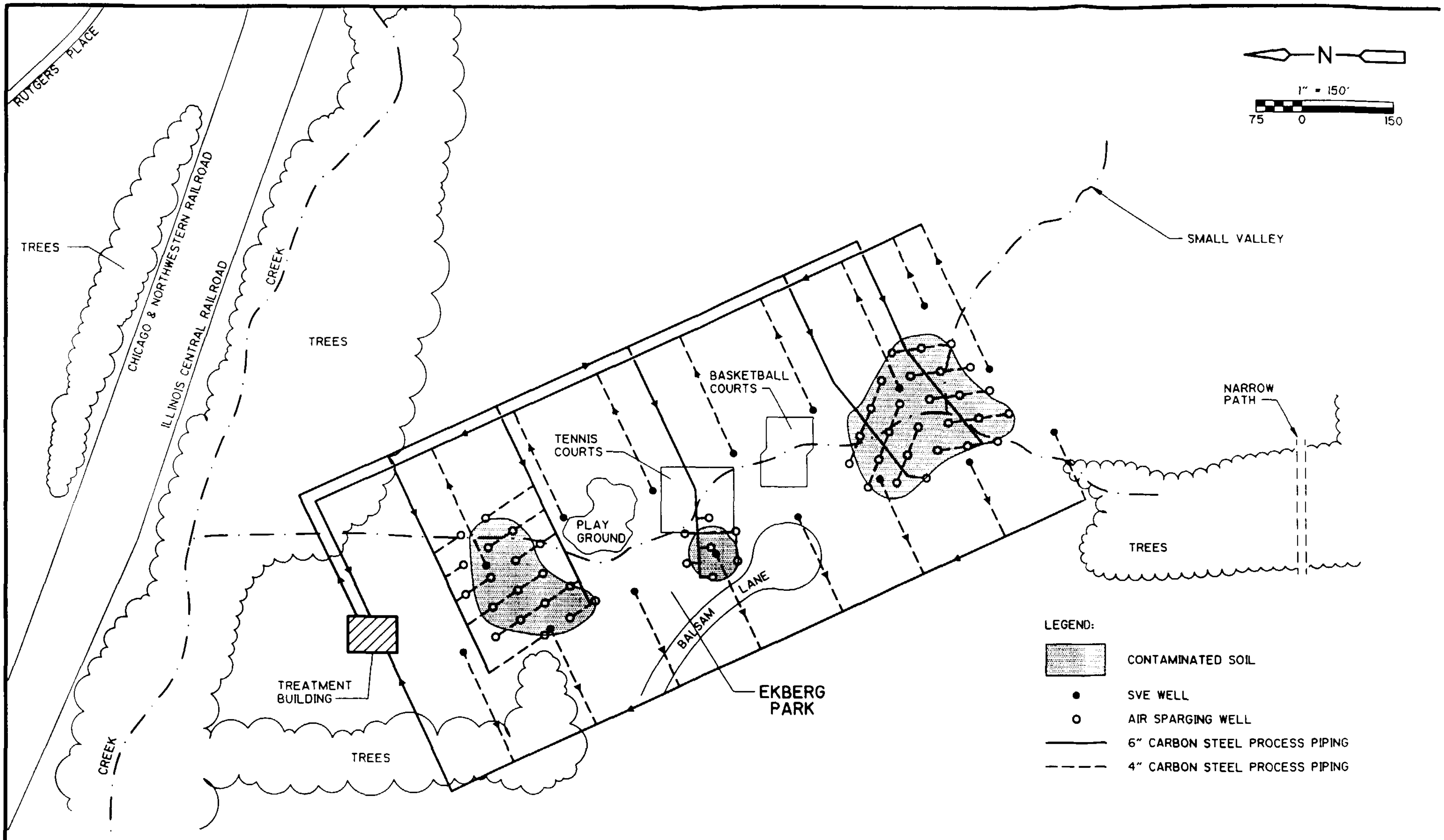

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FIGURE No. 7-6
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 7
SOURCE CONTROL ALTERNATIVE SCS-7E

Short-term Effectiveness

Implementation of this alternative will result in moderate risk/disturbance to on-site workers and the surrounding community during construction. It is anticipated that the exposure scenario associated with this alternative would not be significant.

Implementatability

This alternative is relatively straightforward to implement and the components of a vapor extraction and air sparging system are readily available. These technologies are widely used in similar applications.

Cost

The costs to implement Alternative SCS-7E are shown in **Table 7-9**. The total capital costs associated with this alternative are estimated at $3,071,000. Annual operation and maintenance costs are estimated at $320,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCS-7E would be approximately $5,624,000.

7.4 Detailed Analysis of Soil Source Control Alternatives for Source Area 9/10

This section includes the detailed analysis of alternatives developed for Source Area 9/10. Note for this area, limited data has been collected due to access restrictions by the property owner. The data that has been collected suggests that elevated levels of halogenated volatile organic compounds are present in this area.

Area 9/10 contains three locations that were initially considered as potential source areas. The first is the former Mid-States Industrial property located in the northeast corner of Area 9/10 (referred to as Area 9/10ne), at the intersection of 11th Street and 23rd Avenue. Soil gas, soil, and groundwater data collected during the SCOU RI (CDM 1997) do not support the current existence of a significant soil source area at the former Mid-States property.

The second potential source area is located beneath the building currently occupied by Sundstrand Corporation's Plant #1 (referred to as Area 9/10c). Information from IEPA's project files confirm the existence of underground storage tanks in the loading dock area and in the area south of the loading dock. These tanks contained various liquids, including jet fuel and chlorinated solvents such as 1,1,1-TCA. Immediately downgradient of this solvent storage area, elevated concentrations of TCA (12 mg/L) and other VOCs were found in MW201 (CDM 1997), indicating a nearby upgradient source located beneath Plant #1. However, due to property access restrictions, soil samples could not be collected from beneath Plant #1. As a result, Area 9/10c was not considered in the contaminant fate and transport analysis (Section 5) because the soil

TABLE 7-9
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

SOURCE AREA 7

ALTERNATIVE SCS-7E: SOIL VAPOR EXTRACTION (SVE)/AIR SPARGING (AS) ALONG SOURCE AREA / MONITORING / GROUNDWATER USE RESTRICTIONS / CATALYTIC OXIDATION
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	Groundwater Use Restrictions	$25,000
	General	$167,000
	Leachate Monitoring Wells	$120,000
	VRS/Catalytic Oxidation System	$976,000
	Air Sparging	$694,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$1,982,000**
	Bid Contingency (15%)	$297,000
	Scope Contingency (20%)	$396,000
	Engineering and Design (15%)	$297,000
	Oversight/Health and Safety (5%)	$99,000
	TOTAL CAPITAL COSTS	**$3,071,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	General	$24,000
	VRS Regular Maintenance/Electrical	$63,000
	Leachate Sampling and Analysis (per event)	$28,000
	Catalytic Oxidation Maintenance	$109,000
	Regular System Maintenance/Electrical	$96,000
	TOTAL ANNUAL COSTS	**$320,000**
REPLACEMENT COSTS		
	Leachate Monitoring Wells (every 15 years)	$29,000
	Equipment Replacement (e.g., motors, blowers) - every 15 years	$30,000
	TOTAL REPLACEMENT COSTS (2)	**$59,000**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$3,071,000
	Present Worth Annual O&M Costs (4)	$2,051,000
	Leachate Sampling	
	Quarterly Sampling - years 1 and 2	$207,000
	Semi-annual Sampling - years 3 through 10	$295,000
	Present Worth Replacement Costs (5)	$0
	TOTAL PRESENT WORTH	**$5,624,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over 10 years.
(5) Present worth of replacement costs is based on a 7% annual discount rate and no replacement of leachate monitoring wells and system equipment.

source area is not characterized. Without characterization of the soil source area beneath Plant #1, it is not possible to predict the time required to achieve ARARs for Area 9/10c. Area 9/10w is located at the west end of Sundstrand Plant #1 and it represents a former outdoor drum storage area used to keep chlorinated solvents. This area was included in the contaminant fate and transport analysis because soil chemical concentrations were provided by IEPA's files. It should be noted, however, that data for Area 9/10w is limited to only PCE in soil. Conclusions regarding the time to reach ARARs in Area 9/10 are based only on PCE data from Area 9/10w.

7.4.1 Alternative SCS-9/10A: No Action

For Alternative SCS-9/10A, no remedial actions would be undertaken. The No Action alternative is used as a basis of comparison for evaluating other proposed remedial alternatives under CERCLA.

Overall Protection of Human Health and the Environment

Alternative SCS-9/10A would not be protective of human health or the environment because it would not meet the clean-up goals or provide a reliable means of preventing exposure to site contaminants. The source area contamination would not be eliminated, reduced or controlled, except through natural attenuation mechanisms. Contaminants would continue to leach from soils.

Compliance with ARARs

Alternative SCS-9/10A would not comply with the ARARs for remediating contaminated soils until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms. It is noted that the results of fate and transport indicate that leachate ARARs would be achieved at the GMZ boundary for Area 9/10. However, since limited data exist for Area 9/10, it was not possible to predict the time required to achieve ARARs.

Long-term Effectiveness and Permanence

There would be no long-term maintenance or component replacement requirements as part of this alternative.

Reduction of Toxicity, Mobility or Volume Through Treatment

Because Alternative SCS-9/10A would not include any treatment options, it would not reduce the toxicity, mobility or volume of contaminants at the site, other than through natural attenuation mechanisms.

Short-term Effectiveness

Since no action would be undertaken, this alternative would not pose any short-term risk to the community or the environment as a result of remedial activities.

Implementability

Alternative SCS-9/10A has no actions to implement.

Cost

There are no costs to implement Alternative SCS-9/10A as shown in **Table 7-10**.

7.4.2 Alternative SCS-9/10B: Limited Action - Deed Restrictions

Alternative SCS-9/10B includes placing deed restrictions on the contaminated area. Deed restrictions would be instituted to prevent future site development.

Overall Protection of Human Health and the Environment

Alternative SCS-9/10B would be designed to provide a reduction of the risk to human health by instituting deed restrictions. The restrictions would provide the necessary controls for potential exposure pathways for contaminated soils as well as source leachate.

Compliance with ARARs

Alternative SCS-9/10B would not comply with ARARs for Source Area 9, since contaminants would continue to migrate to the leachate and then into site-wide groundwater. As discussed for the No Action alternative, fate and transport results indicate that ARARs are achieved at the GMZ boundary. Based on the limited data existing for Area 9/10, it was not possible to predict the time required to achieve ARARs for Area 9/10.

Long-term Effectiveness and Permanence

Alternative SCS-9/10B would not achieve any level of long-term effectiveness or permanence. Deed restrictions on future site development would have to be enforced in the long-term to be effective.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative SCS-9/10B would not reduce the toxicity, mobility or volume of contaminants other than through natural attenuation mechanisms.

TABLE 7-10
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 9/10
ALTERNATIVE SCS-9/10A: NO-ACTION (1)
COST SUMMARY

Item/Description		Total Cost
CAPITAL COSTS		
	TOTAL CAPITAL COSTS	**$0**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS		
	TOTAL REPLACEMENT COSTS	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above)	$0
	Present Worth Annual O&M Costs	$0
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$0**

(1) The No Action alternative for Area 9/10 soils is a true "no-action" - no additional measures, which incur cost, will be taken for this alternative.

Short-term Effectiveness

Alternative SCS-9/10B does not provide any level of short-term effectiveness.

Implementability

Deed restrictions would be relatively easy to implement for limiting future site development.

Cost

The costs to implement Alternative SCS-9/10B are shown in **Table 7-11**. The total capital costs associated with this alternative are estimated at $28,000. There are no annual operation and maintenance costs associated with the implementation of this alternative.

7.4.3 Alternative SCS-9/10C: Soil Vapor Extraction

Under this alternative, contaminated soils would be remediated in situ via a vapor extraction system. This alternative will consist of the installation of a series of wells connected by an underground piping system. A blower will provide the source of negative pressure to extract vapors from the subsurface. Four vacuum extraction wells will be placed in the suspected source areas as shown on **Figure 7-7**. The wells will be screened in the vadose zone, where they will remove volatile contaminants from the unsaturated zone as well as some leachate contaminants which are able to diffuse from the surface of the water table.

The spacing of the extraction well system is based on the radius of influence of an individual extraction well. The radius of influence is determined mainly by the ability of vapors to move through the unsaturated soils. For this area, CDM has estimated a radius of influence of 75 feet, however the most effective method of determining the radius of influence is to perform an in situ air permeability test. Therefore a pilot program would be conducted prior to the design and construction of the SVE system.

The vapors collected from the SVE unit will be treated using granular activated carbon. Note that the vapor treatment scenario may be reevaluated based on the results of additional data collection from Area 9/10 and the results of the SVE pilot program.

Overall Protection of Human Health and the Environment

This alternative would reduce risks to human health and the environment by reducing the mass of contaminants available to leach from soils to groundwater.

TABLE 7-11
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 9/10
ALTERNATIVE SCS-9/10B: LIMITED ACTION - DEED RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Deed Restrictions (land use)	$25,000
SUBTOTAL CONSTRUCTION COSTS (1)	**$25,000**
Bid and Scope Contingency (10%)	$2,500
TOTAL CAPITAL COSTS	**$28,000**
ANNUAL OPERATING AND MAINTENANCE COSTS	
None	
TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS	
None	
TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$28,000
Present Worth Annual O&M Costs (4)	$0
Present Worth Replacement Costs	$0
TOTAL PRESENT WORTH	**$28,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.

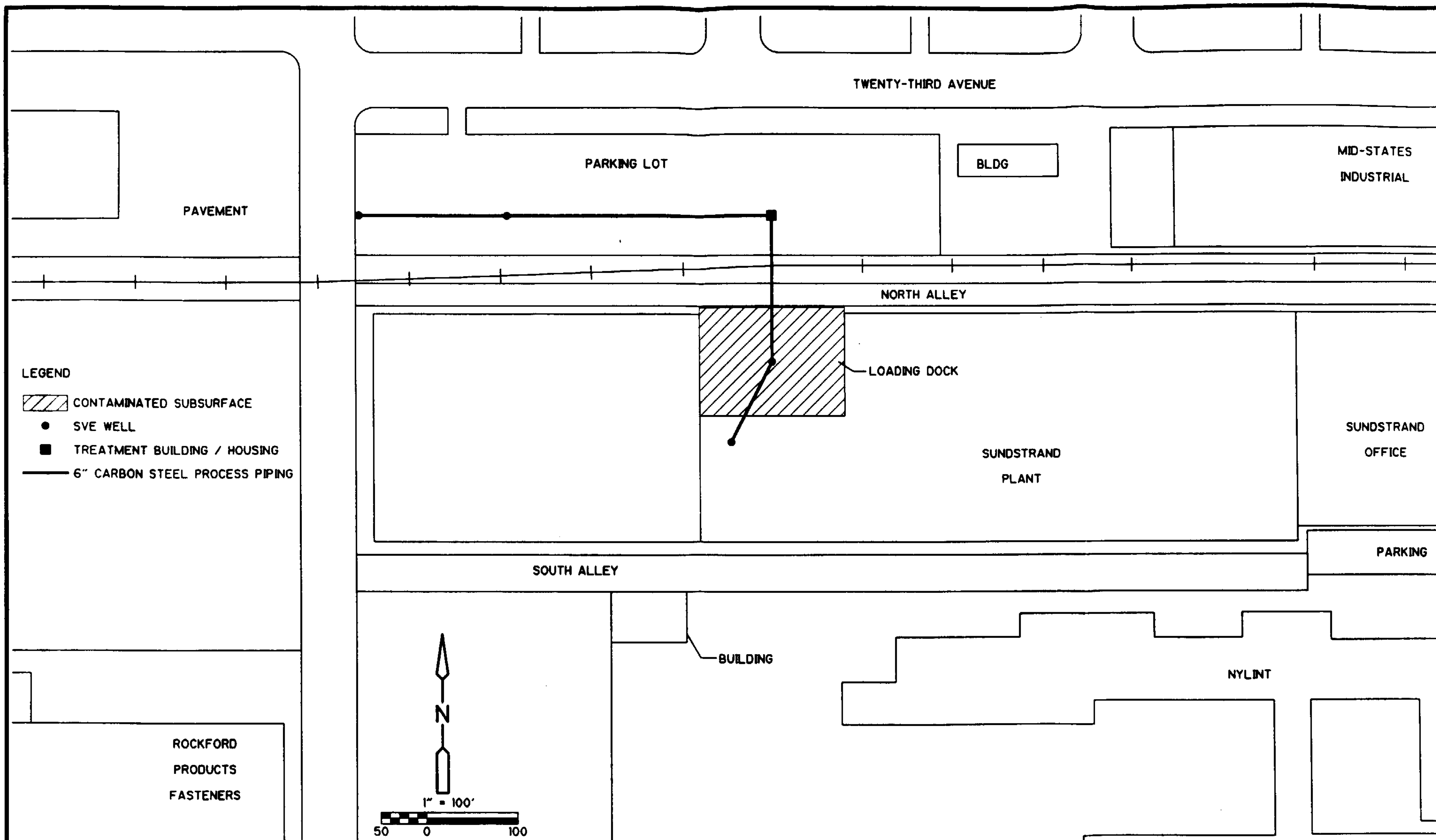

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FIGURE No. 7-7
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 9/10
SOURCE CONTROL ALTERNATIVE SCS-9/10C

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Since this alternative is conducted in situ, there is minimal disturbance to the community and surrounding area.

Compliance with ARARs

This alternative would comply with soil ARARs given that contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated. Emission controls will be required to ensure compliance with air quality standards.

Long-term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of contaminants to leachate. Vapor extraction is a well-demonstrated technology for the removal of VOCs from soils.

Reduction of Toxicity, Mobility, or Volume through Treatment

Implementation of this alternative could result in a significant reduction of toxicity, mobility and volume of contaminants. Emission controls will be implemented to treat the contaminants removed during the vapor extraction process.

Short-term Effectiveness

Implementation of this alternative will result in minimal risks to on-site workers and the surrounding community during construction. It is anticipated that the exposure scenario associated with this alternative would not be significant.

Implementation

This alternative is relatively straightforward to implement and the components of a vapor extraction system are readily available. This technology is widely used in similar applications.

Cost

The costs to implement Alternative SCS-9/10C are shown in **Table 7-12**. The total capital costs associated with this alternative are estimated at $225,000. Annual operation and maintenance costs are estimated at $329,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCS-9/10C would be approximately $4,308,000.

TABLE 7-12
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 9/10
ALTERNATIVE SCS-9/10C: SOIL VAPOR EXTRACTION (SVE)
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	General	$3,000
	Soil Vapor Extraction (w/ emission controls)	$158,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$161,000**
	Bid Contingency (10%)	$16,000
	Scope Contingency (10%)	$16,000
	Engineering and Design (15%)	$24,000
	Oversight/Health and Safety (5%)	$8,000
	TOTAL CAPITAL COSTS	**$225,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	General	$18,000
	Regular System Maintenance/Electrical	$164,000
	Post Treatment Sampling	$147,000
	TOTAL ANNUAL COSTS	**$329,000**
REPLACEMENT COSTS		
	None	
	TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$225,000
	Present Worth Annual O&M Costs (4)	$4,083,000
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$4,308,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.

7.5 Detailed Analysis of Source Control Alternatives for Source Area 11

This section includes the detailed analysis of alternatives developed for Source Area 11. The results of subsurface investigations conducted in this area indicate the presence of residual NAPL. The primary VOCs detected in this area include the aromatic compounds ethylbenzene, toluene and xylene. The results of the fate and transport analysis indicated that groundwater ARARs would be attained for all contaminants of concern within the GMZ boundary under the No Action scenario.

7.5.1 Alternative SCS-11A: No Action

For Alternative SCS-11A, no remedial actions would be undertaken. The No Action scenario alternative is used as a basis of comparison for evaluating other proposed remedial alternatives under CERCLA.

Overall Protection of Human Health and the Environment

Alternative SCS-11A would not be protective of human health or the environment because it would not meet the clean-up goals or provide a reliable means of preventing exposure to site contaminants. The source area contamination would not be eliminated, reduced or controlled, except through natural attenuation mechanisms. Contaminants would continue to leach from soils.

Compliance with ARARs

Alternative SCS-11A would not comply with the soil ARARs for remediating contaminated soils until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms.

Long-term Effectiveness and Permanence

There would be no long-term maintenance or component replacement requirements as part of this alternative.

Reduction of Toxicity, Mobility or Volume Through Treatment

Because Alternative SCS-11A would not include any treatment options, it would not reduce the toxicity, mobility or volume of contaminants at the site, other than through natural attenuation mechanisms.

Short-term Effectiveness

Since no action would be undertaken, this alternative would not pose any short-term risk to the community or the environment as a result of remedial activities.

Implementability

Alternative SCS-11A has no actions to implement.

Cost

There are no costs to implement Alternative SCS-11A as shown in **Table 7-13.**

7.5.2 Alternative SCS-11B: Limited Action - Deed Restrictions

Alternative SCS-11B includes placing deed restrictions on the contaminated area. Deed restrictions would be instituted to prevent future site development.

Overall Protection of Human Health and the Environment

Alternative SCS-11B would be designed to provide a reduction of the risk to human health by instituting deed restrictions. The restrictions would provide the necessary controls for potential exposure pathways for contaminated soils as well as source leachate. However, Alternative SCS-11B would not be protective of the environment as the results of the fate and transport analysis indicate that contaminants in soils are impacting groundwater at the site.

Compliance with ARARs

Alternative SCS-11B would comply with ARARs since the results of the fate and transport analysis indicate that contaminants in soil are not impacting groundwater at the site.

Long-term Effectiveness and Permanence

Alternative SCS-11B would not achieve any level of long-term effectiveness or permanence. Deed restrictions on future site development would have to be enforced over the long-term to be effective.

Reduction of Toxicity, Mobility or Volume through Treatment

Alternative SCS-11B would not reduce the toxicity, mobility or volume of contaminants other than through natural attenuation mechanisms.

Short-term Effectiveness

Alternative SCS-11B does not provide any level of short-term effectiveness.

Implementability

Deed restrictions would be relatively easy to implement for limiting future site development.

TABLE 7-13
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 11
ALTERNATIVE SCS-11A: NO-ACTION (1)
COST SUMMARY

Item/Description		Total Cost
CAPITAL COSTS		
	TOTAL CAPITAL COSTS	**$0**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS		
	TOTAL REPLACEMENT COSTS	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above)	$0
	Present Worth Annual O&M Costs	$0
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$0**

(1) The No Action alternative for Area 11 soils is a true "no-action" - no additional measures, which incur cost, will be taken for this alternative.

Cost

The costs to implement Alternative SCS-11B are shown in **Table 7-14**. The total capital costs associated with this alternative are estimated at $28,000. There are no annual operation and maintenance costs associated with the implementation of this alternative.

7.5.3 Alternative SCS-11C: Soil Vapor Extraction/Catalytic Oxidation

Under this alternative, contaminated soils would be remediated in situ via a vapor extraction system. This alternative will consist of the installation of a series of wells connected by an underground piping system. A blower will provide the source of negative pressure to extract vapors from the subsurface. Five vacuum extraction wells will be placed in the source area as shown on **Figure 7-8**. The wells will be screened in the vadose zone, where they will remove volatile contaminants from the unsaturated zone as well as some leachate contaminants which are able to diffuse from the surface of the water table. Typically, the extraction wells are constructed of polyvinyl chloride material. However, due to the presence of NAPL, it has been assumed that the wells will be constructed of carbon steel.

The spacing of the extraction well system is based on the radius of influence of an individual extraction well. The radius of influence is determined mainly by the ability of vapors to move through the unsaturated soils. For Area 11, CDM has estimated a radius of influence of 75 feet, however the most effective method of determining the radius of influence is to perform an in situ air permeability test. Therefore a pilot program would be conducted prior to the design and construction of the SVE system.

Given the presence of residual NAPL, it is expected that significant quantities of contaminated vapors will be extracted. The vapors will be treated with a catalytic oxidation unit. This system employs a catalyst to facilitate the oxidation of the contaminants. As such, catalytic oxidation units operate at much lower temperatures than thermal incineration systems. The catalyst is a precious metal formulation (e.g., platinum or palladium). Carbon adsorption would not be a cost-effective technology for treating the vapor upon startup of the soil vapor extraction system. It is noted that carbon adsorption could be used to address contaminants in the vapor after contaminant concentration levels were reduced using catalytic oxidation for a period of up to six months to one year. Costs for using a combination of catalytic oxidation and carbon adsorption as part of this alternative are presented in **Appendix D.**

Overall Protection of Human Health and the Environment

This alternative would reduce risks to human health and the environment by reducing the mass of contaminants available to leach from soils to groundwater.

TABLE 7-14
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 11
ALTERNATIVE SCS-11B: LIMITED ACTION - DEED RESTRICTIONS
COST SUMMARY

Item/Description		Total Cost
CAPITAL COSTS		
	Deed Restrictions (land use)	$25,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$25,000**
	Bid and Scope Contingency (10%)	$2,500
	TOTAL CAPITAL COSTS	**$28,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	None	
	TOTAL ANNUAL COSTS	**$0**
REPLACEMENT COSTS		
	None	
	TOTAL REPLACEMENT COSTS (2)	**$0**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$28,000
	Present Worth Annual O&M Costs (4)	$0
	Present Worth Replacement Costs	$0
	TOTAL PRESENT WORTH	**$28,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.

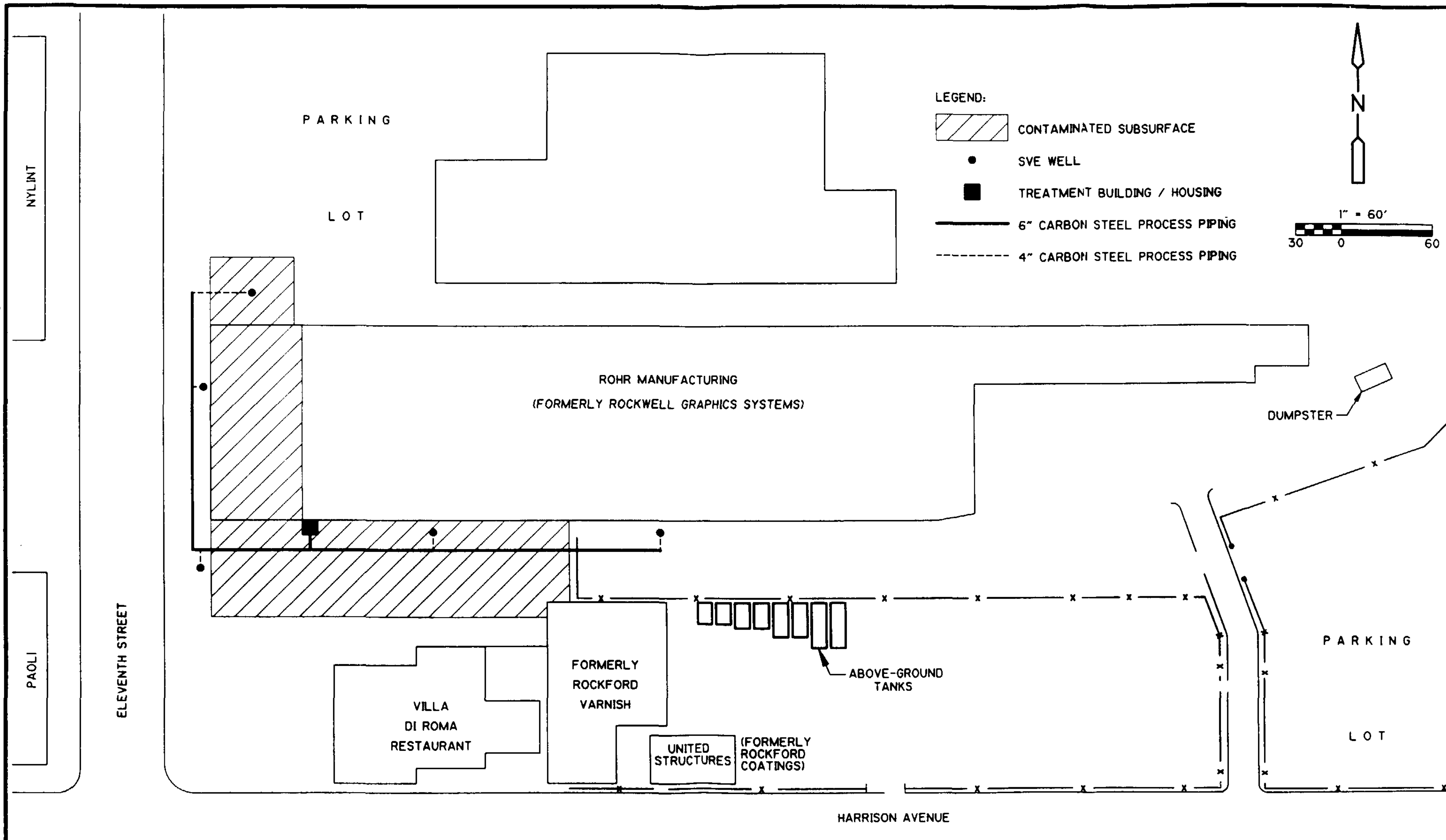

FIGURE No. 7-8
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
SOIL SCHEMATIC LAYOUT FOR AREA 11
SOURCE CONTROL ALTERNATIVE SCS-11C

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Since this alternative is conducted in situ, there is minimal disturbance to the community and surrounding area.

Compliance with ARARs

This alternative would comply with ARARs given that contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated. Given that residual NAPL has been found at the water table interface, emission controls will be required to ensure compliance with air quality standards.

There is the potential for dioxins to be present in the vapor stream, though at low levels. Sampling will be conducted to monitor the presence of dioxins.

Long-term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of contaminants to leachate. Vapor extraction is a well-demonstrated technology for the removal of VOCs from soils.

Reduction of Toxicity, Mobility, or Volume through Treatment

Implementation of this alternative could result in a significant reduction of toxicity, mobility and volume of contaminants. However, residual NAPL at the water table interface could result in the continuing release of contaminants to the unsaturated zone. Emission controls will be implemented to treat the contaminants removed during the vapor extraction process.

Short-term Effectiveness

Implementation of this alternative will result in minimal risks to on-site workers and the surrounding community during construction. It is anticipated that the exposure scenario associated with this alternative would not be significant.

Implementation

This alternative is relatively straightforward to implement and the components of a vapor extraction system are readily available. This technology is widely used in similar applications.

Cost

The costs to implement Alternative SCS-11C are shown in **Table 7-15**. The total capital costs associated with this alternative are estimated at $543,500. Annual operation and maintenance costs are estimated at $212,880. Assuming a discount rate of seven percent, the net present worth of Alternative SCS-11C would be approximately $3,185,500.

TABLE 7-15
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FEASIBILITY STUDY

SOURCE AREA 11
ALTERNATIVE SCS-11C: SOIL VAPOR EXTRACTION (SVE) / CATALYTIC OXIDATION
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
General	$3,000
Soil Vapor Extraction (with emission controls)	$242,000
Catalytic Oxidation System	$143,500
SUBTOTAL CONSTRUCTION COSTS (1)	$388,500
Bid Contingency (10%)	$39,000
Scope Contingency (10%)	$39,000
Engineering and Design (15%)	$58,000
Oversight/Health and Safety (5%)	$19,000
TOTAL CAPITAL COSTS	$543,500
ANNUAL OPERATING AND MAINTENANCE COSTS	
General	$18,000
Regular System Maintenance/Electrical	$36,000
Catalytic Oxidation System Maintenance	$68,880
Post Treatment Sampling	$90,000
TOTAL ANNUAL COSTS	$212,880
REPLACEMENT COSTS	
TOTAL REPLACEMENT COSTS (2)	$0
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$543,500
Present Worth Annual O&M Costs (4)	$2,642,000
Present Worth Replacement Costs	$0
TOTAL PRESENT WORTH	$3,185,500

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.
Note: SVE present worth costs are based on 30 year operation.

7.6 Detailed Analysis of Source Control Leachate Alternatives for Source Area 4

7.6.1 Alternative SCL-4A: No Action/Leachate Monitoring/ Restrictions on Groundwater Usage/Natural Attenuation

This alternative includes implementing institutional controls and a groundwater and leachate monitoring program. Institutional controls restricting groundwater usage would be recorded with the State and the City. Monitoring would be implemented by installing four additional monitoring wells - two within and two downgradient of the source area. These wells, along with two additional existing wells, will be sampled for VOCs on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

Overall Protection of Human Health and the Environment

Implementing institutional controls (groundwater use restrictions) will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. However, the No Action alternative is not necessarily protective of downgradient receptors because contaminants are allowed to migrate into the site-wide groundwater without control beyond that which is naturally occurring. Therefore, human and environmental receptors in downgradient locations are not protected from future contamination by the No Action alternative.

Note that the extent to which future contaminant migration would occur from the leachate into the site-wide groundwater is dependent significantly upon the selected soil remedial alternative. For example, if an alternative was selected that would completely remove the contaminant mass, such as the excavation alternative for Source Area 4, there may be no significant contaminant mass in the unsaturated or saturated zones to contribute to the leachate. It might be expected, under this alternative, therefore, that the leachate concentrations would begin to decline given the lack of source materials. If site-wide groundwater receptors are of adequate distance downgradient such that natural attenuation processes would reduce contaminant mass to protective levels given the declining concentrations of contaminants in the leachate, then the No Action alternative may be considered protective.

However, the No Action alternative is not considered protective when coupled with the other soil remedial alternatives, since the other soil alternatives do not guarantee that all of the NAPL will be removed. Without the NAPL removed, the leachate could continue to be impacted by dissolved contaminants, thereby impacting site-wide groundwater.

Compliance with ARARs

This alternative would not comply with ARARs at the GMZ boundary for at least 60 to 70 years given that contaminant concentrations above MCLs would continue to migrate from the soil and leachate into the site-wide groundwater. This condition would hold true independent of which soil remedial alternative is implemented. The length of time associated with the leachate exceeding MCLs would, however, be dependant upon the soil remedial alternative selected. If the NAPL was removed through excavation, then the leachate may achieve an average concentration equivalent to MCLs within a relatively short time frame compared to a matter of decades to centuries, if the NAPL is not removed.

Long-Term Effectiveness and Permanence

The importance of long-term effectiveness and permanence with respect to managing downgradient risk will be somewhat reliant upon the soil remediation strategy implemented. However, the No Action alternative would not, in itself, achieve any level of long-term effectiveness or permanence. If NAPL removal through excavation is included in the selected soil alternative, which is both effective and permanent, then the lack of effectiveness or permanence associated with the No Action alternative may not be significant. However, with most of the soil alternatives, the No Action alternative does not provide an adequate level of long-term effectiveness or permanence to manage downgradient risks.

Reduction of Toxicity, Mobility or Volume through Treatment

Since the No Action alternative does not include any treatment of the leachate beyond that which is naturally occurring, this alternative would not reduce the toxicity, mobility, or volume of the contaminants in the leachate.

Short-Term Effectiveness

The No Action alternative does not provide any level of short-term effectiveness with regard to the source area leachate or the site-wide groundwater.

Implementability

Implementation of the No Action alternative will require that three tasks be performed, which are in fact part of all the other leachate alternatives. These tasks include the installation of new monitoring wells, planning and implementing a new environmental monitoring program, and preparing the necessary papers for the deed for recording the deed restrictions.

The construction of new monitoring wells is straightforward, given that the technologies to be used and the sampling methods are all well established. The potential difficulty in implementing the construction of the new monitoring wells will be in obtaining access to the proposed drilling sites. Planning and implementing the new sampling program can be performed readily. These types of programs have been put together before, and many examples exist from which to draw. Finally, the deed needs to be recorded with the State and other appropriate entities. The procedures for this type of activity are well established and can be followed without significant difficulty. Therefore, all of the proposed No Action alternative tasks can be implemented without significant difficulty.

Cost

The costs to implement Alternative SCL-4A are shown in **Table 7-16**. The total capital costs associated with this alternative are estimated at $54,000. Annual operation and maintenance costs are $7,000, and replacement costs are estimated at $29,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-4A would be approximately $269,000.

7.6.2 Alternative SCL-4B: Limited Action/Leachate Monitoring, Leachate Collection and Treatment by Air Stripping Unit/Off-site Surface Water Discharge/Groundwater Use Restrictions

This alternative combines the elements of the No Action alternative together with a hydraulic containment scenario to be implemented along the downgradient side of the GMZ. Hydraulic containment of the leachate at the GMZ boundary would be achieved through the construction of a limited groundwater pump and treat system. The groundwater would be extracted through a series of six extraction wells, treated using air stripping and discharged on site into neighboring surface waters. A schematic showing the alternative, including the proposed locations for the extraction wells, is presented in **Figure 7-9**.

Monitoring will be required during system operations to maintain permit compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs, as well as the standard NPDES permit monitoring requirements (i.e., total dissolved solids, nitrate, nitrite, phosphorous, etc.).

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing four additional monitoring wells - two within the GMZ and two downgradient of the GMZ - as shown on **Figure 7-9**. These wells, along with two additional downgradient wells, will be sampled for VOCs on a quarterly sampling program for 2 years followed by a semi-annual program for years 3 through 30, based

TABLE 7-16

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

SOURCE AREA 4 - LEACHATE
ALTERNATIVE SCL-4A: NO ACTION / LEACHATE MONITORING/ RESTRICTIONS ON GROUNDWATER USAGE/ NATURAL ATTENUATION
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Monitoring Wells	$18,000
SUBTOTAL CONSTRUCTION COSTS	$43,000
Bid and Scope Contingency (20%)	$9,000
Oversight/Health and Safety (5%)	$2,000
TOTAL CAPITAL COSTS (1)	$54,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Sampling and Analysis (per event)	$7,000
TOTAL ANNUAL COSTS	$7,000
REPLACEMENT COSTS (2)	
Monitoring Well Replacement (every 15 years)	$29,000
TOTAL REPLACEMENT COSTS	$29,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$54,000
Present Worth Annual O&M Costs (4)	
Leachate Sampling	
Quarterly Sampling - years 1 and 2	$52,000
Semi-annual Sampling - years 3 through 30	$149,000
Present Worth Replacement Costs (5)	$14,000
TOTAL PRESENT WORTH	$269,000

(1) Capital costs for construction items do not include oversight fees.

(2) Replacement costs include construction *and* oversight capital costs.

(3) Capital costs represent the present worth of the given alternative.

(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).

(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells replacement every 15 years.

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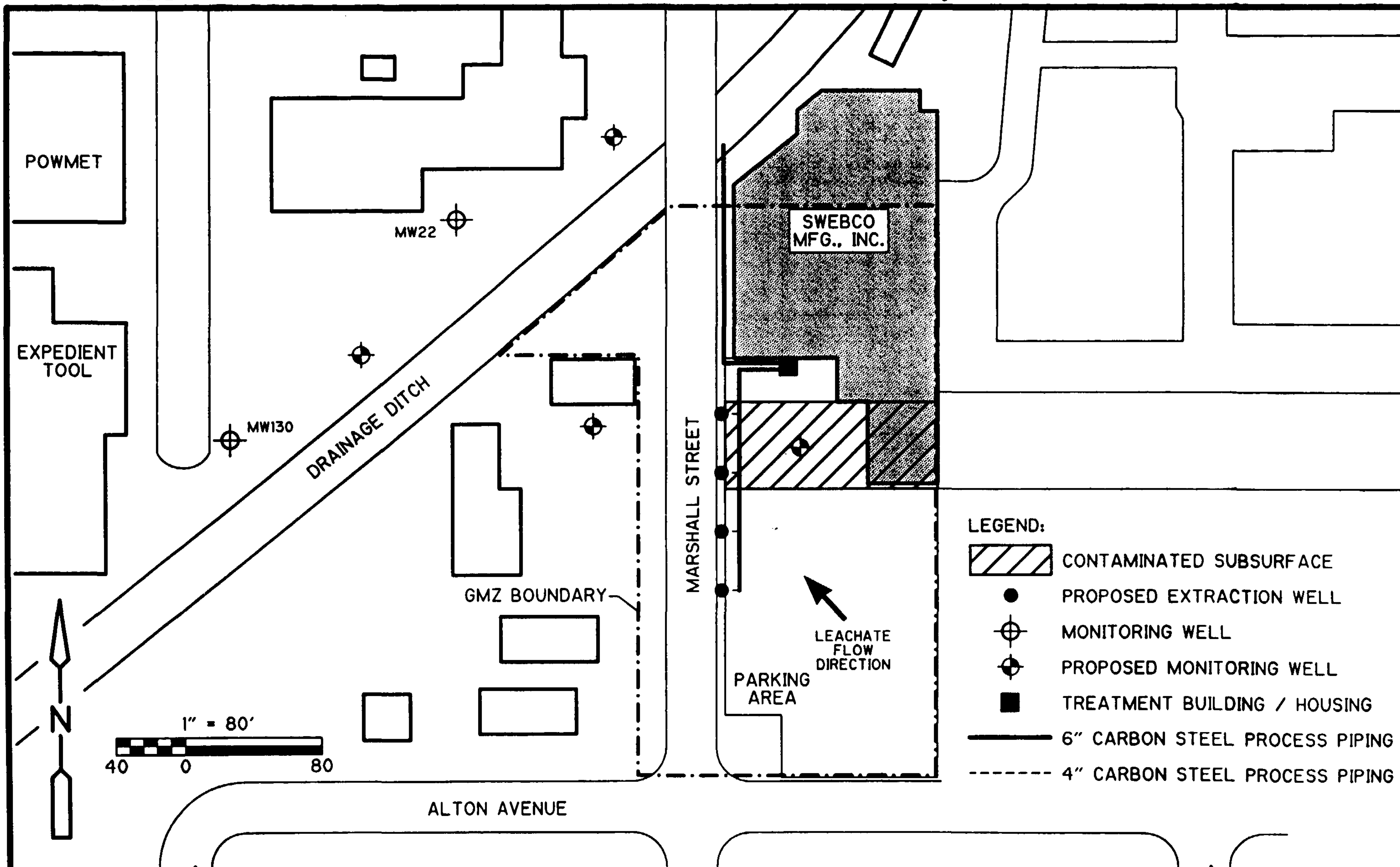

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FIGURE No. 7-9
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 4
SOURCE CONTROL ALTERNATIVE SCL-4B

on RCRA closure guidelines. These wells will also be instrumented to collect water level data on a semi-continuous rate to monitor extraction system performance.

It is anticipated that groundwater extraction activities will persist over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected. It is possible, even likely, that if the NAPL source is removed under the soil excavation alternative, then the groundwater extraction system could be discontinued before 30 years occurs, however, a 30-year planning horizon was used to simplify the analyses.

Overall Protection of Human Health and the Environment

Due to the shallow depth of contamination, in this source area, implementing institutional controls within the boundaries of the GMZ will eventually be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The hydraulic containment option also is protective of downgradient receptors of the GMZ since contaminated leachate is contained at the boundary of the GMZ, and removed for treatment and discharge. Only those contaminants downgradient of the GMZ, within the site-wide groundwater, would impact downgradient receptors. To this end, the hydraulic containment option is protective of human health and the environment.

Compliance with ARARs

This alternative would not comply with ARARs at the boundary of the GMZ given that contaminant concentrations above MCLs would continue to exist in the site-wide groundwater. However, this alternative would eliminate the continued migration of contaminants from the GMZ into site-wide groundwater above ARARs within 35 to 45 years. Although continued operation of the groundwater extraction system would overtime reduce contaminant concentrations in the site-wide groundwater, it may take a significant amount of time for concentrations in the downgradient groundwater to decrease to MCLs or below.

This condition would hold true independent of which soil remedial alternative is implemented, since the soil remedy would only impact leachate concentrations within the GMZ. The length of time associated with the leachate exceeding MCLs would, however, be dependant upon the soil remedial alternative selected, but this would only impact leachate concentrations within the GMZ. Note that there are no groundwater quality ARARs within the GMZ.

Long-Term Effectiveness and Performance

This alternative offers both long-term effectiveness and permanence for containing the migration of leachate from the GMZ into site-wide groundwater. The groundwater extraction system can be operated over long periods of time and can effectively eliminate the downgradient migration of leachate across the GMZ boundary. This holds true independent of which soil remedy is selected.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility or Volume Through Treatment

This alternative directly effects the mobility of contaminant migration in the site-wide groundwater. By intercepting leachate as it migrates across the GMZ boundary, the contaminants are removed from the shallow flow system prior to their migration into downgradient areas. Therefore, this alternative effectively limits the mobility of the leachate-borne contaminants. Minimal reduction in contaminant toxicity and volume is realized through the implementation of hydraulic containment.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant.

Implementability

The technologies associated with this alternative are proven and widely used in similar applications. In addition, the proposed location of the wells and pipelines are in locations that are reasonably easy to access. Therefore, this alternative is relatively straightforward to implement.

The only difficult aspect of this alternative to implement may be the surface water discharge, since surface discharge permits often entail the control of constituents that are not related to the GMZ such as total dissolved solids or nutrients. Although this aspect of the alternative may not significantly impact the implementability of the alternative, it may make the alternative unimplementable.

Cost

The costs to implement Alternative SCL-4B are shown in **Table 7-17**. The total capital costs associated with this alternative are estimated at $249,000. Annual operation and maintenance costs are $16,000, and replacement costs are estimated at $107,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-4B would be approximately $732,000.

TABLE 7-17

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
FOCUSED FEASIBILITY STUDY
ROCKFORD, ILLINOIS

AREA 4 - LEACHATE
ALTERNATIVE SCL-4B: LIMITED ACTION / LEACHATE MONITORING / LEACHATE COLLECTION AND TREATMENT BY AIR STRIPPING UNIT / OFF-SITE SURFACE WATER DISCHARGE / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Containment System	$118,000
Leachate Monitoring Wells	$18,000
SUBTOTAL CONSTRUCTION COSTS (1)	$161,000
Bid Contingency (15%)	$24,000
Scope Contingency (20%)	$32,000
Engineering and Design (15%)	$24,000
Oversight/Health and Safety (5%)	$8,000
TOTAL CAPITAL COSTS	$249,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Containment System	$7,000
Leachate Containment System Sampling and Analysis (per event)	$4,000
Leachate Sampling and Analysis (per event)	$5,000
TOTAL ANNUAL COSTS	$16,000
REPLACEMENT COSTS (2)	
Leachate Containment System (every 15 years)	$78,000
Monitoring Well Replacement (every 15 years)	$29,000
TOTAL REPLACEMENT COSTS	$107,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$249,000
Present Worth Annual O&M Costs (4)	$87,000
Leachate Containment System	
Quarterly Sampling - years 1 through 30	$200,000
Leachate Monitoring Wells	
Quarterly Sampling - years 1 and 2	$37,000
Semi-annual Sampling - years 3 through 30	$106,000
Present Worth Replacement Costs (5)	$53,000
TOTAL PRESENT WORTH	$732,000

(1) Capital costs for construction items do not include oversight fees.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells replacement and leachate collection system (including extraction wells, piping, pumps, and air stripping unit) every 15 years.

7.6.3 Alternative SCL-4C: Air Sparging along GMZ Boundary/ Leachate Monitoring/Groundwater Use Restrictions

This alternative combines the elements of the Limited Action alternative together with an air sparging injection well system located downgradient along the northwestern boundary of the GMZ. The air sparge system would be constructed to strip groundwater of VOCs *in situ* through the injection of air. The gas and stripped solvents would be collected using vapor extraction wells. A schematic showing the alternative, including the proposed locations for the sparge wells, is presented in **Figure 7-10**. Six sparge wells and three vapor extraction wells will be located along the boundary of the GMZ.

Given the presence of residual NAPL, it is expected that significant quantities of contaminated vapors will be extracted. The vapors will be treated with a catalytic oxidation unit. This system employs a catalyst to facilitate the oxidation of the contaminants. As such, catalytic oxidation units operate at much lower temperatures than thermal incineration systems. The catalyst is a precious metal formulation (e.g., platinum or palladium).

Monitoring will be required during system operation to maintain air quality permitting compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs, only.

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing four additional monitoring wells - two within the GMZ and two downgradient of the GMZ - as shown on **Figure 7-10**. These wells, along with two additional downgradient wells, will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

It is anticipated that the air sparging and subsequent monitoring activities will persist over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected. It is possible, even likely, that if the NAPL source is removed under the soil excavation alternative, then the air sparge system could be discontinued before 30 years occurs, however, a 30-year planning horizon was used to simplify the analyses.

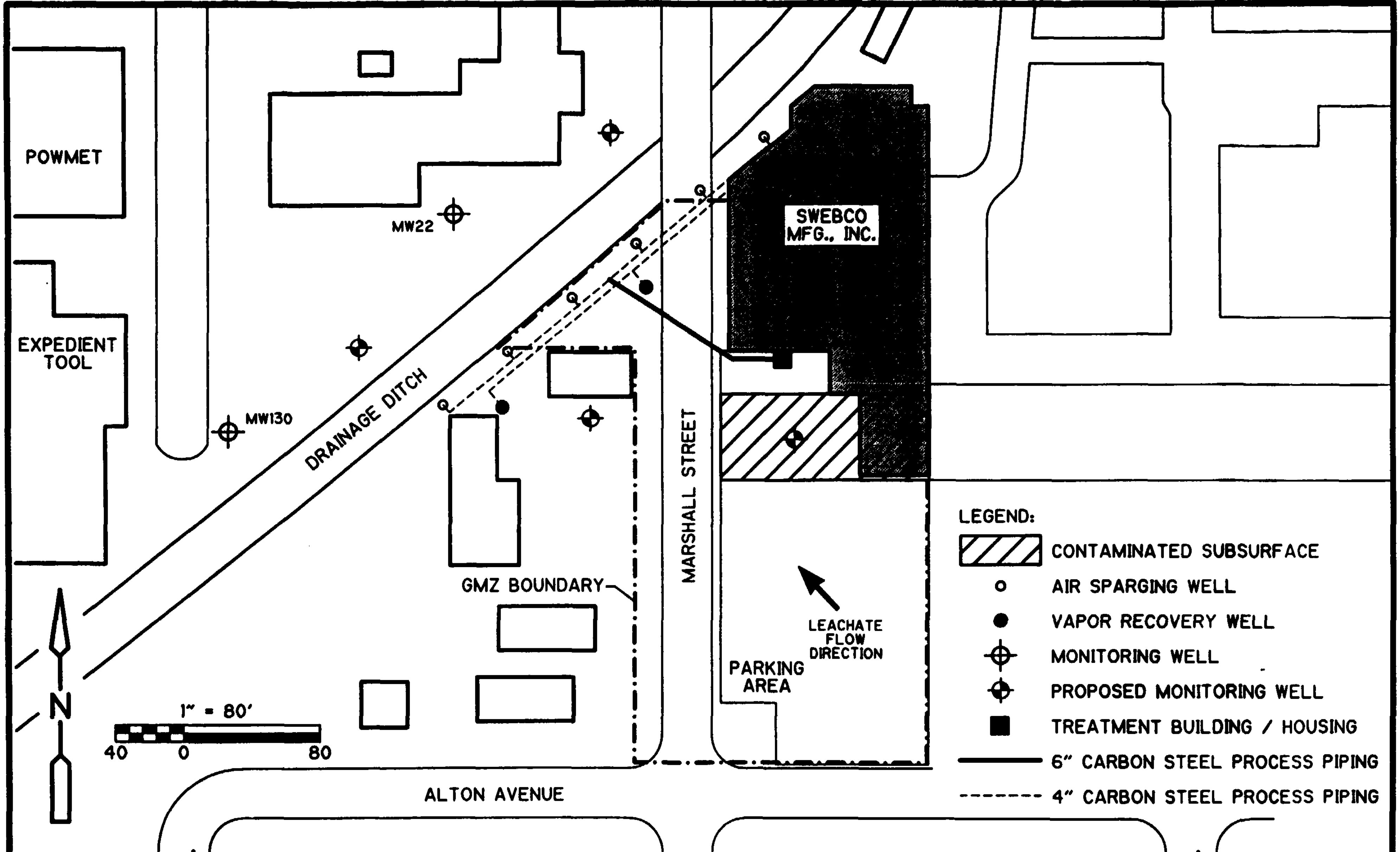

FIGURE No. 7-10
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 4
SOURCE CONTROL ALTERNATIVE SCL-4C

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Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The air sparging well point system is also protective of downgradient receptors of the GMZ since contaminated leachate is treated *in situ* prior to its discharge into the site-wide groundwater at the boundary of the GMZ. To this end, the air sparge alternative is protective of human health and the environment downgradient of the GMZ.

Compliance with ARARs

This alternative would eventually comply with ARARs at the boundary of the GMZ given that contaminant concentrations above MCLs would be treated to below MCLs as leachate passes through the well point system prior to discharging to site-wide groundwater. In this way, this alternative eliminates the continued migration of contaminants above ARARs from the GMZ into site-wide groundwater after a period of 15 to 25 years. Implementing this alternative does effectuate treatment of limited areas of the contaminant mass within the saturated soils and all of the leachate at those areas adjacent to the well point system. However, the NAPLs beneath the source areas are not treated directly such that the contaminant mass would be depleted only through separate soil source control activities or via natural processes. Therefore, it will be on the order of decades to centuries before the leachate throughout the GMZ will be below ARARs. ARARs will be attained at the GMZ boundary in from 15 to 25 years.

Long-Term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of leachate from the GMZ into site-wide groundwater. The air sparge technology can be operated reliably over long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates. Since the treatment system has been placed at the downgradient boundary of the GMZ, the air sparge system will control the migration of leachate from the GMZ into site-wide groundwater. Therefore, this treatment system does offer complete long-term effectiveness in meeting the RAOs.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the mobility of the contaminated leachate. By stripping the contamination from the leachate as it migrates across the hot spots within the GMZ, the contaminants are removed from the shallow flow system prior to their migration into downgradient areas. Therefore, this alternative effectively limits the mobility of the leachate-borne contaminants.

Contaminated vapors extracted via the soil vapor extraction system will be treated in a catalytic oxidation unit. Therefore, a reduction in contaminant toxicity and volume will be realized through the implementation of this alternative.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant.

Implementability

The technologies associated with this alternative are proven and widely used in similar applications. In addition, the proposed location of the wells and pipelines are reasonably easy to access. Therefore, this alternative is considered relatively straightforward to implement.

Cost

The costs to implement Alternative SCL-4C are shown in **Table 7-18**. The total capital costs associated with this alternative are estimated at $2,037,000. Annual operation and maintenance costs are $57,000, and replacement costs are estimated at $39,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-4C would be approximately $2,522,000.

7.6.4 Alternative SCL-4D: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

This alternative combines the elements of the No Action alternative together with a funnel and gate reactive barrier scenario to be constructed at the downgradient boundary of the GMZ. The reactive barrier system would be constructed to treat the leachate of VOCs *in situ* as it leaves the GMZ through the reactive gate. A schematic showing the alternative is presented in **Figure 7-11.**

Monitoring will be required during use of the wall to characterize compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs. This alternative also includes implementing institutional controls within the

TABLE 7-18
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

AREA 4 - LEACHATE
ALTERNATIVE SCL-4C: AIR SPARGING ALONG GMZ BOUNDARY/ LEACHATE MONITORING / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description		Total Cost
CAPITAL COSTS		
	Groundwater Use Restrictions	$25,000
	General	$1,038,000
	VRS	$180,000
	Air Sparging	$62,000
	Leachate Monitoring Wells	$9,000
	SUBTOTAL CONSTRUCTION COSTS (1)	**$1,314,000**
	Bid Contingency (10%)	$197,000
	Scope Contingency (20%)	$263,000
	Engineering and Design (15%)	$197,000
	Oversight/Health and Safety (5%)	$66,000
	TOTAL CAPITAL COSTS	**$2,037,000**
ANNUAL OPERATING AND MAINTENANCE COSTS		
	VRS Maintenance/Electrical	$26,000
	Leachate Sampling and Analysis (per sample event)	$5,000
	Air Sparging System Maintenance/Electrical	$26,000
	TOTAL ANNUAL COSTS	**$57,000**
REPLACEMENT COSTS		
	Leachate Monitoring Wells (every 15 years)	$29,000
	Equipment Replacement (e.g., motors, blowers) - every 15 years	$10,000
	TOTAL REPLACEMENT COSTS (2)	**$39,000**
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$2,037,000
	Present Worth Annual O&M Costs (4)	$323,000
	Quarterly Sampling - years 1 and 2	$37,000
	Semi-annual Sampling - years 3 through 30	$106,000
	Present Worth Replacement Costs (5)	$19,000
	TOTAL PRESENT WORTH	**$2,522,000**

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of system equipment and monitoring wells every 15 years (twice over 30 year projection).

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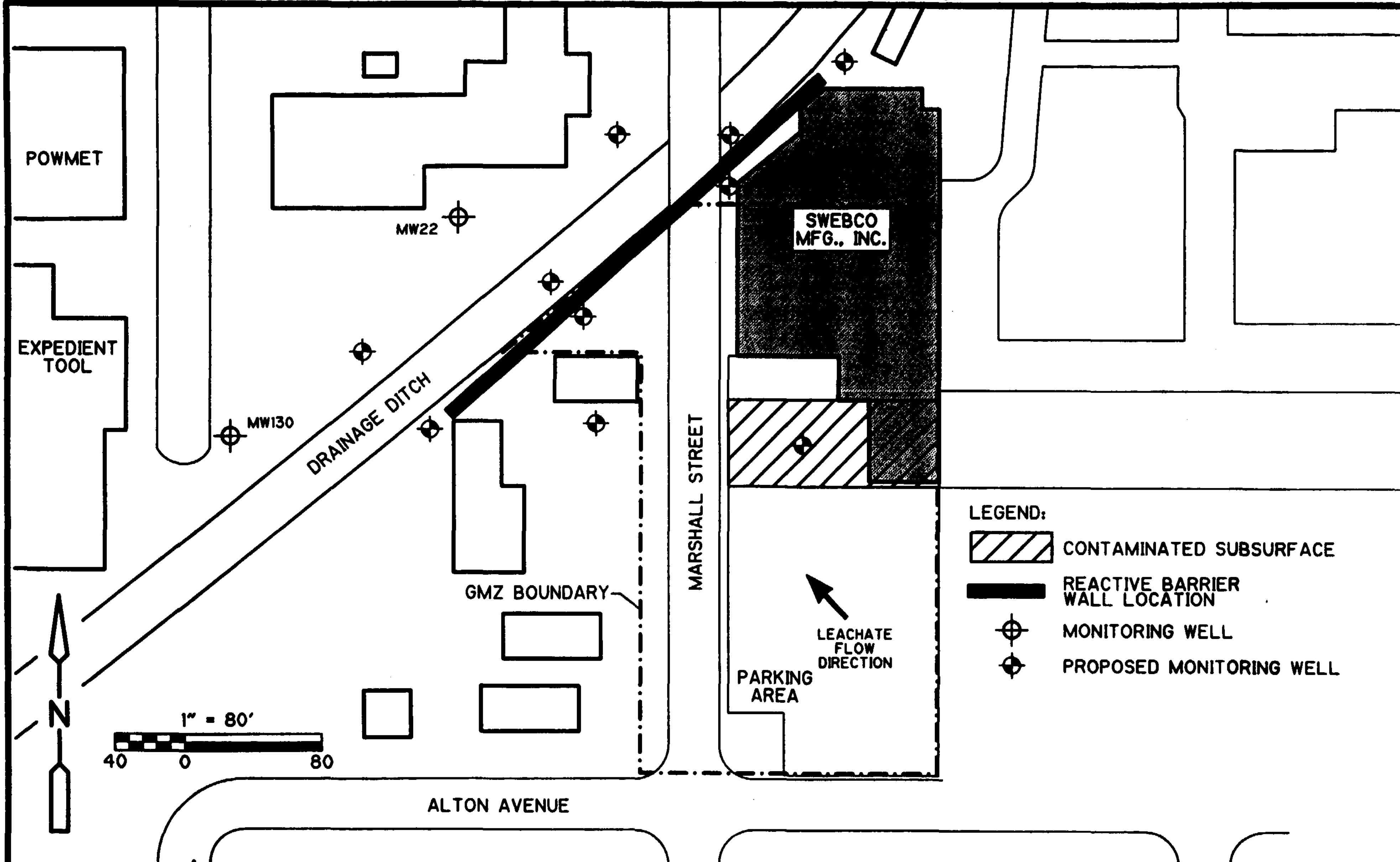

FIGURE No. 7-11
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 4
SOURCE CONTROL ALTERNATIVE SCL-4D

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GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing four additional monitoring wells - two within the GMZ and two downgradient of the GMZ - as shown on Figure 7-11. These wells, along with two additional downgradient wells, will be sampled for VOCs on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

It is anticipated that the reactive barrier will be continuously in use and monitored over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected. It is possible, even likely, that if the NAPL source is removed under the soil excavation alternative, then the need of the reactive wall could be discontinued before 30 years occurs, however, monitoring would continue and thus a 30-year planning horizon was used to simplify the analyses.

Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The reactive barrier option is also protective of downgradient receptors of the GMZ since contaminated leachate is treated *in situ* prior to its discharge into the site-wide groundwater at the boundary of the GMZ. Therefore, the reactive barrier is protective of downgradient human health and the environment.

Compliance with ARARs

This alternative would comply with ARARs at the boundary of the GMZ immediately after construction and in operation. This alternative does eliminate the continued migration of contaminants from the GMZ into site-wide groundwater. Implementing this alternative does effectuate treatment of the contaminant mass within the saturated soils and the leachate, such that the leachate passing from the GMZ into the site-wide groundwater will be below the MCLs.

Note that leachate not meeting ARARs would continue to persist unless a soil remedy is implemented that greatly reduces the volume and mobility of the contaminant mass.

Long-Term Effectiveness and Permanence

This alternative offers both long-term effectiveness and permanence for controlling the migration of leachate above MCLs from the GMZ into site-wide groundwater. The reactive barrier technology can be operated reliably over relatively long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates, such that this treatment technology can control the migration of leachate from the GMZ into site-wide groundwater. Therefore, the reactive barrier is both effective and permanent.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the toxicity and volume of the contaminated leachate. By treating the contamination *in situ* as the leachate migrates across the GMZ boundaries, the contaminants are destroyed prior to their migration into downgradient areas. Therefore, this alternative effectively reduces the toxicity and volume of the leachate-borne contaminants.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant. There may also be some public concerns as well given construction within an industrial and public setting.

Implementability

The technologies associated with this alternative are proven and have been used in similar applications. However, the location of the trench is not located on a single property, and is located near a drainage way, adjacent to structures and utilities, which are somewhat deep in excavation, all of which may influence construction. As with any trench, underground utilities, and dewatering complicate construction. It is likely that these factors can be managed during design and construction of the reactive barrier, however there are issues that impact the implementability of this alternative that do not impact other alternatives.

Cost

The costs to implement Alternative SCL-4D are shown in Table 7-19. The total capital costs associated with this alternative are estimated at $5,659,000. Annual operation and maintenance costs are $7,000, and replacement costs are estimated at $83,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-4D would be approximately $5,911,000.

7.6.5 Alternative SCL-4E: Air Sparging along GMZ Boundary and Source Area/Leachate Monitoring/Groundwater Use Restrictions

This alternative combines the elements of the No Action alternative together with an air sparging scenario to be implemented in the source area and within the boundary of the GMZ. Air sparging which can be implemented along with the soil remedy of SVE would be achieved through the construction of an air sparge system of wells and blowers. The air sparge system would be constructed to strip groundwater within the GMZ of VOCs *in situ* through the injection of air into specially designed well bubblers. The gas and stripped solvents would be collected in the SVE system above the water table to protect human health and the environment. A schematic showing the alternative, including the proposed locations for the sparge wells, is presented in **Figure 7-12.** Six air sparge wells and three vapor extraction wells will be installed at the GMZ boundary and operated with a vapor recovery system similar to SCL-4C. However, for alternative SCL-4E, four sparge wells will be installed near the source area.

Given the presence of residual NAPL, it is expected that significant quantities of contaminated vapors will be extracted. The vapors will be treated with a catalytic oxidation unit. This system employs a catalyst to facilitate the oxidation of the contaminants. As such, catalytic oxidation units operate at much lower temperatures than thermal incineration systems. The catalyst is a precious metal formulation (e.g., platinum or palladium).

Monitoring will be required during system operations to maintain air quality permitting compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs, only.

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

TABLE 7-19

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
FOCUSED FEASIBILITY STUDY
ROCKFORD, ILLINOIS

AREA 4 - LEACHATE
ALTERNATIVE SCL-4D: REACTIVE BARRIER WALL / LEACHATE MONITORING / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Reactive Barrier Wall	$3,580,000
Leachate Monitoring Wells	$45,000
SUBTOTAL CONSTRUCTION COSTS (1)	$3,650,000
Bid Contingency (15%)	$548,000
Scope Contingency (20%)	$730,000
Engineering and Design (15%)	$548,000
Oversight/Health and Safety (5%)	$183,000
TOTAL CAPITAL COSTS	$5,659,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Sampling and Analysis (per event)	$7,000
TOTAL ANNUAL COSTS	$7,000
REPLACEMENT COSTS (2)	
Iron Rejuvenation	$25,000
Monitoring Well Replacement (every 15 years)	$58,000
TOTAL REPLACEMENT COSTS	$83,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$5,659,000
Present Worth Annual O&M Costs (2)	
Quarterly Sampling - years 1 and 2	$52,000
Semi-annual Sampling - years 3 through 30	$149,000
Present Worth Replacement Costs (3)	$51,000
TOTAL PRESENT WORTH	$5,911,000

(1) Replacement costs include construction *and* oversight capital costs.

(2) Capital costs represent the present worth of the given alternative.

(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).

(3) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells every 15 years and iron rejuvenation every 10 years (three times over 30 year projection).

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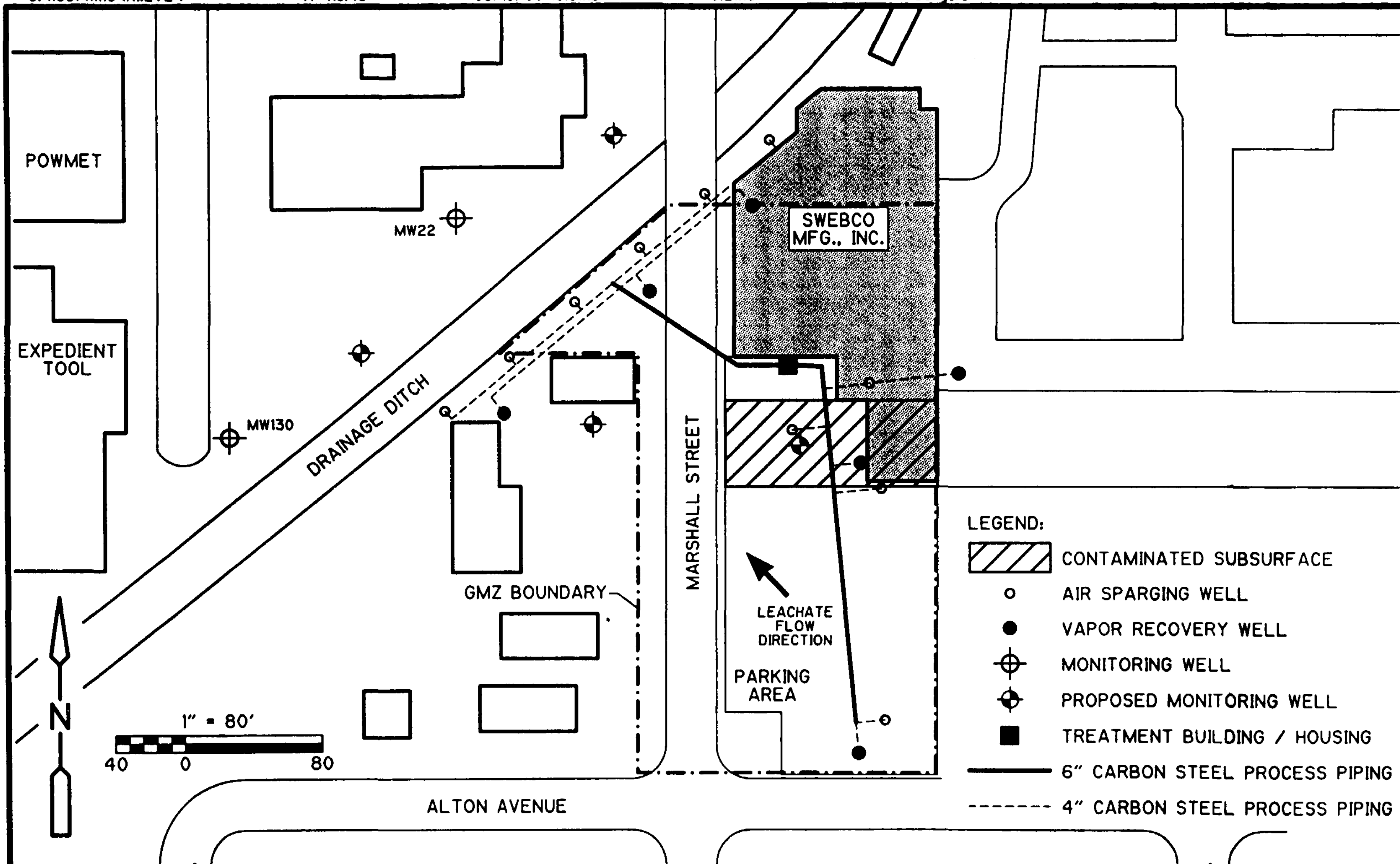

FIGURE No. 7-12
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

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FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 4
SOURCE CONTROL ALTERNATIVE SCL-4E

As with the No Action alternative, groundwater monitoring would be implemented by installing four additional monitoring wells - two within the GMZ and two downgradient of the GMZ - as shown on **Figure 7-12**. These wells, along with two additional downgradient well, will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

It is anticipated that the air sparging activities will persist over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected. It is possible, albeit unlikely, that if the NAPL source is removed under the implementation of a soil remedy that the air sparge system could be discontinued before 30 years occurs, however, a 30-year planning horizon was used to simplify the analyses.

Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The air sparging option is also protective of downgradient receptors of the GMZ since contaminated leachate is treated *in situ* prior to its discharge into the site-wide groundwater at the boundary of the GMZ. Further, this air sparge alternative addresses the leachate within the GMZ. To this end, the air sparge alternative protects human health and the environment downgradient of the GMZ.

Compliance with ARARs

This alternative would comply with ARARs for leachate at the boundary of the GMZ within 10 to 20 years given that treatment will also occur at the source, therefore reducing the migration of contaminants from the GMZ into site-wide groundwater. Implementing this alternative does effectuate treatment of the contaminant mass within the saturated soils and the leachate, such that eventually the leachate within the GMZ will be below the MCL. Again note that air sparging must be conducted with the SVE soil remedy to control off gas and protect human health near the source areas.

Long-Term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of leachate from the GMZ into site-wide groundwater. The air sparge system is a technology that can be operated reliably over long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates. Therefore, the air sparge system does offer complete long-term effectiveness in meeting the RAOs.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the mobility of the contaminated leachate. By stripping the contamination from the leachate as it migrates across the hot spots within the GMZ, the contaminants are removed from the shallow flow system prior to their migration into downgradient areas. Therefore, this alternative effectively limits the mobility of the leachate-borne contaminants.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant. Construction workers would be protected by OSHA-approved protective clothing and equipment.

Implementability

The technologies associated with this alternative are proven and widely used in similar applications. In addition, the proposed location of the wells and pipelines are in locations that are reasonably easy to access. Therefore, this alternative is considered relatively straightforward to implement.

Cost

The costs to implement Alternative SCL-4E are shown in **Table 7-20**. The total capital costs associated with this alternative are estimated at $2,306,000. Annual operation and maintenance costs are $57,000, and replacement costs are estimated at $49,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-4E would be approximately $2,796,000. Note that since it is expected that the source control alternative to be implemented will be SVE, the costs to place vapor extraction wells in the source area and emissions control are not included in the overall costs of this alternative. If SVE is not implemented, then these costs will have to added to this cost.

TABLE 7-20
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

AREA 4 - LEACHATE
ALTERNATIVE SCL-4E: AIR SPARGING ALONG GMZ BOUNDARY AND SOURCE AREA / LEACHATE MONITORING / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	Groundwater Use Restrictions	$25,000
	General	$1,038,000
	VRS	$312,000
	Air Sparging	$104,000
	Leachate Monitoring Wells	$9,000
	SUBTOTAL CONSTRUCTION COSTS (1)	$1,488,000
	Bid Contingency (15%)	$223,000
	Scope Contingency (20%)	$298,000
	Engineering and Design (15%)	$223,000
	Oversight/Health and Safety (5%)	$74,000
	TOTAL CAPITAL COSTS	$2,306,000
ANNUAL OPERATING AND MAINTENANCE COSTS		
	Leachate Sampling and Analysis (per sample event)	$5,000
	VRS Regular System Maintenance/Electrical	$26,000
	Air Sparging Regular System Maintenance/Electrical	$26,000
	TOTAL ANNUAL COSTS	$57,000
REPLACEMENT COSTS		
	Leachate Monitoring Wells (every 15 years)	$29,000
	Equipment Replacement (e.g., motors, blowers) - every 15 years	$20,000
	TOTAL REPLACEMENT COSTS (2)	$49,000
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$2,306,000
	Present Worth Annual O&M Costs (4)	$323,000
	Quaterly Sampling - years 1 and 2	$37,000
	Semi-annual Sampling - years 3 through 30	$106,000
	Present Worth Replacement Costs (5)	$24,000
	TOTAL PRESENT WORTH	$2,796,000

(1) Capital costs for contstruction items do not include oversight fees, which are accounted for separatel
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per samplin schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of system equipment every 15 years (once over 30 year projection) and monitoring wells every 30 year

7.7 Detailed Analysis of Source Leachate Control Alternatives for Source Area 7

7.7.1 Alternative SCL-7A: No Action/Leachate Monitoring/ Groundwater Use Restrictions/Natural Attenuation

This alternative includes implementing institutional controls and a groundwater and leachate monitoring program. Institutional controls restricting groundwater usage would be recorded with the State and the City. Monitoring would be implemented by installing five additional monitoring wells - three within and two downgradient of the source area. These wells, along with four existing monitoring wells will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

Overall Protection of Human Health and the Environment

Implementing institutional controls will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. However, the No Action alternative is not necessarily protective of downgradient receptors because contaminants are allowed to migrate into the site-wide groundwater without control beyond that which is naturally occurring. Therefore, human and environmental receptors in downgradient locations are not protected from future contamination by the No Action alternative.

Note that the extent to which future contaminant migration would occur from the leachate into the site-wide groundwater is dependent significantly upon the selected soil remedial alternative. For example, if an alternative was selected that would completely remove the contaminant mass, there may be no significant additional contaminant mass in the unsaturated or saturated zones to contribute to the leachate. It might be expected, under this alternative, therefore, that the leachate concentrations would begin to decline given the lack of source materials.

If site-wide groundwater receptors are of adequate distance downgradient such that natural attenuation processes would reduce contaminant mass to protective levels given the declining concentrations of contaminants in the leachate, then the No Action alternative may be considered protective. However, given the proximity of the creek, it is unlikely that natural attenuation would adequately reduce contaminant concentrations prior to their discharge. Therefore, the No Action alternative is not considered protective of human health and the environment, especially with respect to the site-wide groundwater and downgradient receptors.

Compliance with ARARs

This alternative would not comply with ARARs given that contaminant concentrations above MCLs would continue to migrate from the leachate into the site-wide groundwater. It is estimated that from 80 to 90 years would be required to attain ARARs at the GMZ boundary. The length of time associated with the leachate exceeding MCLs would, however, be dependant upon the soil remedial alternative selected. If the NAPL was removed through excavation, then the leachate may achieve an average concentration equivalent to MCLs within a relatively short time frame compared to a matter of decades to centuries, if the NAPL is not removed.

Long-Term Effectiveness and Permanence

The importance of long-term effectiveness and permanence with respect to managing downgradient risk will be somewhat reliant upon the soil remediation strategy implemented. However, the No Action alternative would not, in itself, achieve any level of long-term effectiveness or permanence. If NAPL removal through excavation is included in the selected soil alternative, which is both effective and permanent, then the lack of effectiveness or permanence associated with the No Action alternative may not be significant.

Note that institutional controls which are a component of the No Action alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls will be permanent. However, these controls are a part of all the alternatives, and therefore, do not improve the long-term effectiveness or permanence of the No Action alternative with respect to the other alternatives.

Reduction of Toxicity, Mobility, and/or Volume through Treatment

Since the No Action alternative does not include any treatment of the leachate beyond that which is naturally occurring, this alternative would not reduce the toxicity, mobility, or volume of the contaminants in the leachate.

Short-Term Effectiveness

The No Action alternative does not provide any level of short-term effectiveness with regard to the source area leachate or the site-wide groundwater.

Implementability

Implementation of the No Action alternative will require three tasks be performed, which are in fact part of all the other leachate alternatives. These tasks include install new monitoring wells, planning and implementing a new environmental monitoring program, and preparing the necessary papers for the deed recordation.

The construction of new monitoring wells is straightforward, given that the technologies to be used and the sampling methods are all well established. The potential difficulty in implementing the construction of the new monitoring wells will be in obtaining access to the proposed drilling sites. Although access can be obtained, it may take time for the proper access agreements to be negotiated. Planning and implementing the new sampling program can be performed readily. These types of programs have been put together before, and many examples exist from which to draw. Finally, the deed needs to be recorded with the State and other appropriate entities. The procedures for this type of activity are well established and can be followed without significant difficulty. Therefore, all of the proposed No Action alternative tasks can be implemented without significant difficulty.

Cost

The costs to implement Alternative SCL-7A are shown in **Table 7-21**. The total capital costs associated with this alternative are estimated at $67,000. Annual operation and maintenance costs are $9,000, and replacement costs are estimated at $44,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-7A would be approximately $347,000.

7.7.2 Alternative SCL-7B: Multi-Phase Extraction/Collect Leachate and Treat by Air Stripping Unit/Discharge to On-site Surface Water/Groundwater Use Restrictions/Monitoring

This alternative combines the elements of the No Action alternative together with multi-phase extraction (MPE) system to be implemented in the source and a hydraulic containment system to be implemented along the downgradient side of the GMZ. Hydraulic containment of the leachate at the GMZ boundary would be achieved through the construction of a limited groundwater pump and treat system. The groundwater would be extracted through a series of eight extraction wells at a flow rate of 10 gallons per minute, treated using air stripping and discharged on site into neighboring surface waters. A schematic showing the proposed locations for the leachate extraction wells is presented in **Figure 7-13**.

Monitoring will be required during system operations to maintain permit compliance and to evaluate treatment system efficiency. Containment system monitoring parameters will include VOCs, as well as the standard NPDES permit monitoring requirements (i.e., total dissolved solids, nitrate, nitrite, phosphorous, etc.).

Multi-Phase Extraction (MPE) can be generally defined as the application of a vacuum to an extraction well, resulting in the extraction of a combination of the following phases - non-aqueous phase liquids (NAPLs), groundwater and soil vapor. The applied vacuum typically extracts soil vapors and enhances groundwater and NAPL recovery. There are several configurations of MPE that have been used, depending on the phases of contaminant present (e.g. light versus dense NAPLs) and the subsurface

TABLE 7-21

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

SOURCE AREA 7 - LEACHATE
ALTERNATIVE SCL-7A: NO ACTION / LEACHATE MONITORING/ GROUNDWATER USE RESTRICTIONS/ NATURAL ATTENUATION
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Monitoring Wells	$23,000
SUBTOTAL CONSTRUCTION COSTS	$48,000
Bid Contingency (15%)	$7,000
Scope Contingency (20%)	$10,000
Oversight/Health and Safety (5%)	$2,000
TOTAL CAPITAL COSTS	$67,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Sampling and Analysis (per event)	$9,000
TOTAL ANNUAL COSTS	$9,000
REPLACEMENT COSTS (1)	
Monitoring Well Replacement (every 15 years)	$44,000
TOTAL REPLACEMENT COSTS	$44,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (2)	$67,000
Present Worth Annual O&M Costs	
Quarterly Sampling - years 1 and 2	$67,000
Semi-annual Sampling - years 3 through 30	$191,000
Present Worth Replacement Costs (3)	$22,000
TOTAL PRESENT WORTH	$347,000

(1) Replacement costs include construction *and* oversight capital costs.

(2) Capital costs represent the present worth of the given alternative.

(3) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells every 30 years.

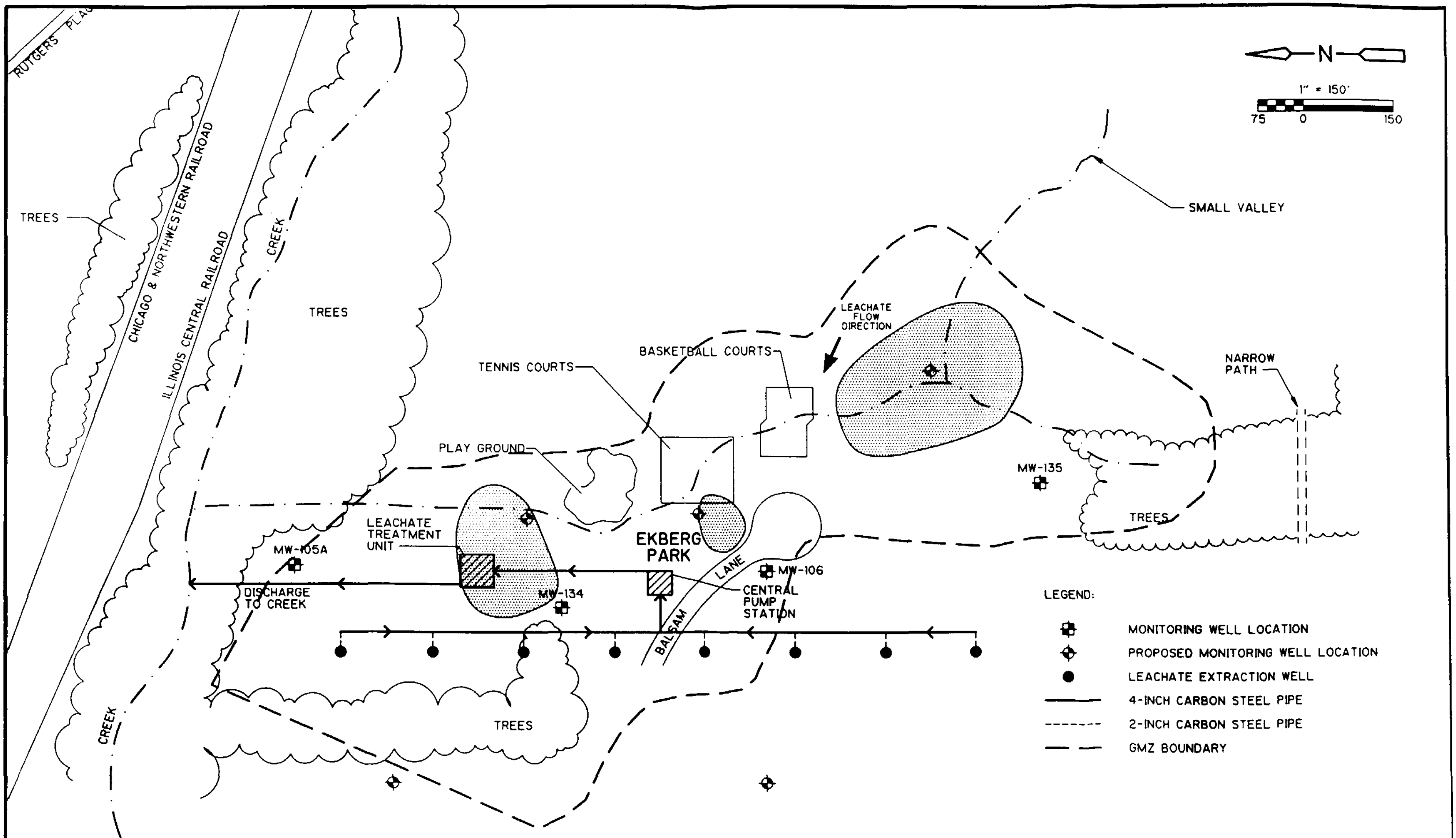

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FIGURE No. 7-13
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE CONTAINMENT SCHEMATIC LAYOUT FOR
AREA 7, SOURCE CONTROL ALTERNATIVE SCL-7B

conditions. The extent of effective remediation of a MPE well is dependent on the extent of groundwater drawdown that is achieved. The greater the volume of soil that is dewatered, the greater the volume of soil that is remediated by SVE that is induced during MPE. In addition, the greater the drawdown, the greater the groundwater and NAPL (if present) recovery rate.

The subsurface conditions and contaminants at Source Area 7 make MPE applicable for remediating source soils. The target soils are moderately permeable and the contaminants are all volatile thus providing conditions that are favorable for removal of contaminants in the vapor phase during MPE.

Pilot testing would be performed to determine MPE well spacing, and vapor and leachate extraction rates. To approximate the costs of a MPE system, an assumed radius of influence of MPE wells of 25 feet, a leachate extraction rate of 0.5 gpm/well and vapor extraction rate of 25 scfm/well have been assumed. The latest definition of the source areas has been used to conceptually locate MPE wells as shown in **Figure 7-14**. Each of these 10 wells would be installed in the source to a depth of approximately 25 feet and be piped underground to a central vacuum pump/vapor treatment system enclosure. The enclosure would also include an air/water separator, with the water pumped to the leachate containment system air stripper.

It has been assumed that six additional monitoring wells would be installed to monitor the saturated zone of treatment of the MPE wells. In addition, nine vadose zone pressure monitoring points would be installed to monitor the treatment zone in unsaturated soils.

It has been assumed that it will be necessary to further define exactly where the areas of highest contamination are located to focus MPE. To do this an innovative geophysical method would be used prior to designing the MPE system. A geophysical method that measures the relative resistivity of the subsurface would be applied. Since the presence of contaminants results in an increase in resistivity within the subsurface, a three-dimensional depiction of relative resistance can be used to identify areas of contamination. Vertical induction profiling (VIP) and surface induction profiling (SIP) use electromagnetic induction to define in three-dimension anomalies that are indicative of contamination. This method can detect contaminants in both the soil and groundwater. To provide complimentary information on the site geology, gamma ray and EM-39 logging would also be performed.

The geophysical survey would use monitoring wells to collect subsurface readings. It is anticipated that existing monitoring wells MW-105A, MW-134, MW-106 and MW-135 would be used in the survey. In addition, the three new monitoring wells that are proposed for the leachate containment system would also be used in the survey. **Figure 7-15** shows the Geophysical Survey layout for Area 7.

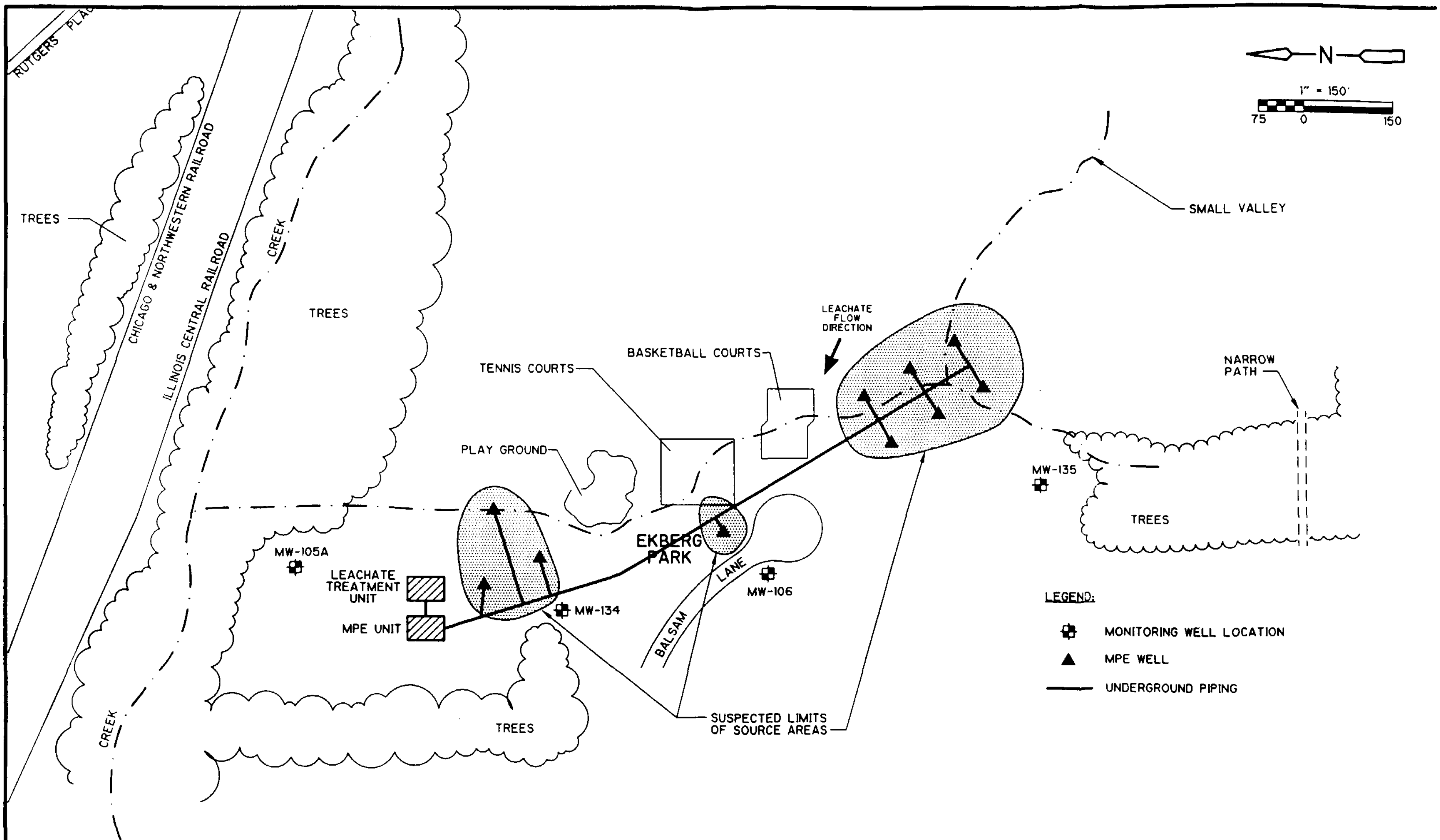

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FIGURE No. 7-14
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
MPE SCHEMATIC LAYOUT FOR AREA 7
SOURCE CONTROL ALTERNATIVE SCL-7B

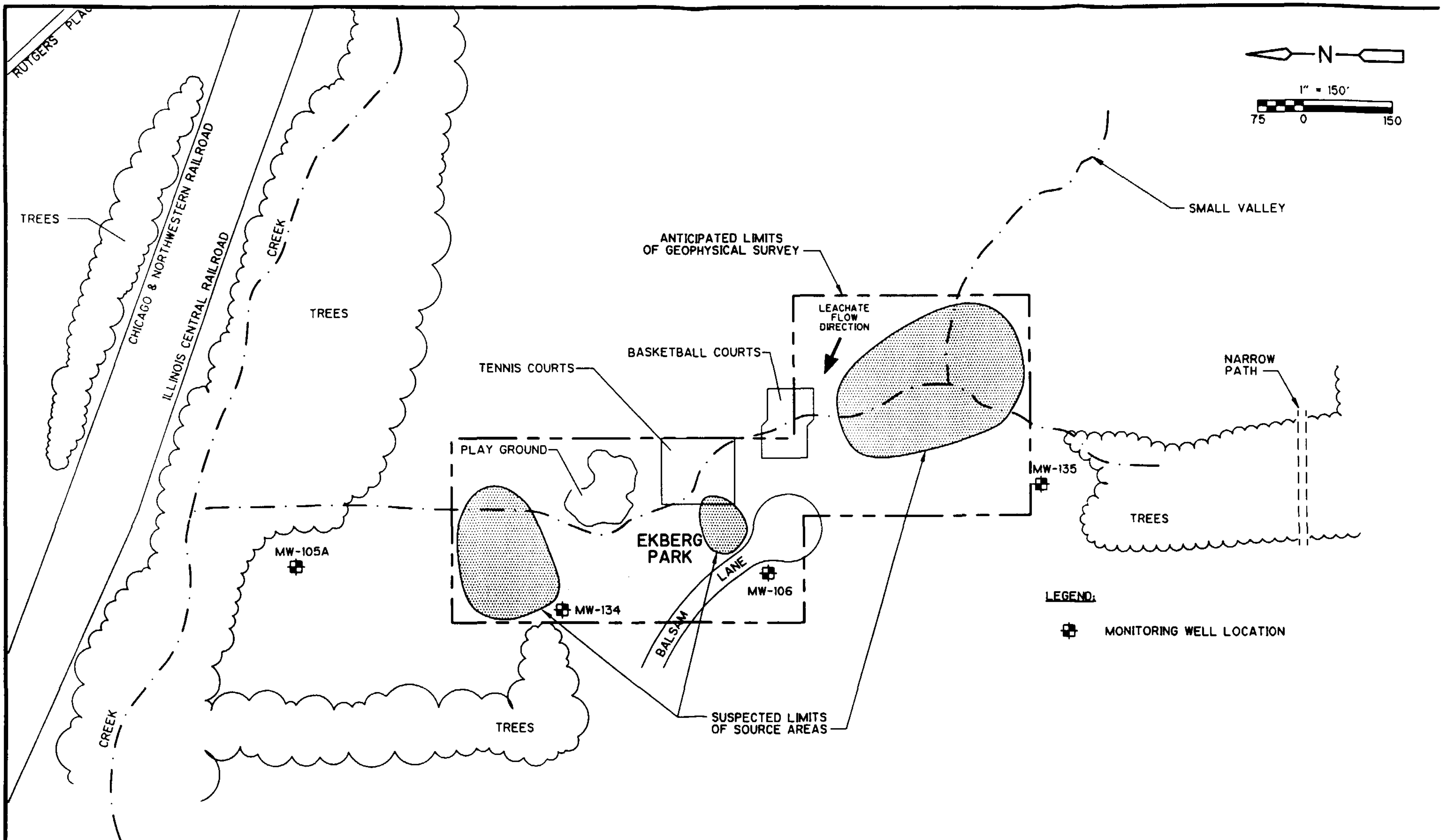

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FIGURE No. 7-15
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY
GEOPHYSICAL SURVEY LAYOUT FOR AREA 7
SOURCE CONTROL ALTERNATIVE SCL-7B

The results of the survey will be a color 2D contour map of the SIP data and a color 3D model of the VIP data. In addition, color graphics will be provided that display the VIP results as depth and vertical slice views and 3D oblique perspective views.

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both within and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing five additional monitoring wells - three within the GMZ and two downgradient of the GMZ - as shown on **Figure 7- 13**. These wells, along with four existing monitoring wells, will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines. These wells will also be instrumented to collect water level data on a semi-continuous rate to monitor extraction system performance.

It is anticipated that groundwater extraction activities will persist over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected. It is possible, albeit unlikely, that if the NAPL source is removed by implementation of the MPE system and a soil remedy, then the groundwater extraction system could be discontinued before 30 years occurs, however, a 30-year planning horizon was used to simplify the analyses.

Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. This alternative is also protective of downgradient receptors of the GMZ since contaminated leachate is contained at the boundary of the GMZ, and removed for treatment and discharge. Only those contaminants downgradient of the GMZ, within the site-wide groundwater, would impact downgradient receptors. To this end, this alternative is protective of human health and the environment. The MPE component of this alternative would accelerate the rate of contaminant removal and further reduce soil and leachate contaminant concentrations within the most contaminated areas.

Compliance with ARARs

This alternative would not comply with ARARs at the boundary of the GMZ for approximately 30 years given that contaminant concentrations above MCLs would continue to exist in the site-wide groundwater. However, this alternative would eventually eliminate the continued migration of contaminants from the GMZ into site-wide groundwater. Although continued operation of the groundwater extraction system would overtime reduce contaminant concentrations in the site-wide groundwater, it may take a significant amount of time for concentrations in the downgradient groundwater to decrease to MCLs or below.

This condition would hold true independent of which soil remedial alternative is implemented, since the soil remedy would only impact leachate concentrations within the GMZ. The length of time associated with the leachate exceeding MCLs would, however, be dependant upon the soil remedial alternative selected, but this would only impact leachate concentrations within the GMZ. Note that there are no groundwater quality ARARs within the GMZ.

Long-Term Effectiveness and Permanence

This alternative offers both long-term effectiveness and permanence for containing the migration of leachate from the GMZ into site-wide groundwater. The groundwater extraction system technology can be operated over long periods of time and can effectively eliminate the downgradient migration of leachate across the GMZ boundary. This holds true independent of which soil remedy is selected. The accelerated contaminant removal rate offered by MPE would add to the long term effectiveness and permanence of this alternative.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the mobility of contaminant migration in the site-wide groundwater. By intercepting leachate as it migrates across the GMZ boundary and treating leachate with MPE within the GMZ, the contaminants are removed from the shallow flow system prior to their migration into downgradient areas. Therefore, this alternative effectively limits the mobility of the leachate-borne contaminants.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers would not be significant.

Implementability

The technologies associated with this alternative are proven and have been used in similar applications. In addition, the proposed location of the wells and pipelines are in locations that are reasonably easy to access. Therefore, this alternative is considered relatively straightforward to implement.

The only difficult aspect of this alternative to implement may be the surface water discharge, since surface discharge permits often entail the control of constituents that are not related to the GMZ such as total dissolved solids or nutrients.

Cost

The costs to implement Alternative SCL-7B are shown in **Table 7-22**. The total capital costs associated with this alternative are estimated at $1,435,000. Annual operation and maintenance costs are $128,000, and replacement costs are estimated at $326,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-7B would be approximately $2,637,000.

7.7.3 Alternative SCL-7C: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

This alternative combines the elements of the No Action alternative together with a funnel and gate reactive barrier scenario to be constructed at the downgradient boundary of the GMZ. The reactive barrier system would be constructed to treat the leachate of VOCs *in situ* as it leaves the GMZ through the reactive gate. A schematic showing the alternative is presented in **Figure 7-16.**

Monitoring will be required during use of the wall to characterize compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs.

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing five additional monitoring wells - three within the GMZ and two downgradient of the GMZ - as shown on **Figure 7-16**. These wells, along with four existing monitoring wells will be sampled for VOCs on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

It is anticipated that the reactive barrier will be used over the entire 30 years of the planning horizon used for costing in the FFS to maintain leachate below MCLs from migrating beyond the GMZ. This assumption is independent of the type of soil remedy selected. It is possible, that if the NAPL source is removed under the soil excavation alternative, then the reactive wall could be discontinued before 30 years occurs. However, a 30-year planning horizon was used to simplify the analyses.

TABLE 7-22

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
FOCUSED FEASIBILITY STUDY
ROCKFORD, ILLINOIS

AREA 7 - LEACHATE
ALTERNATIVE SCL-7B: MULTI-PHASE EXTRACTION/ COLLECT LEACHATE AND TREAT BY AIR STRIPPING UNIT / DISCHARGE TO ON-SITE SURFACE WATER / GROUNDWATER USE RESTRICTIONS/MONITORING
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Containment System	$322,000
Leachate Monitoring Wells	$23,000
Multiphase Extraction in Source Areas	$425,000
Multiphase Extraction Monitoring	$44,000
Geophysical Survey	$87,000
SUBTOTAL CONSTRUCTION COSTS (1)	$926,000
Bid Contingency (15%)	$139,000
Scope Contingency (20%)	$185,000
Engineering and Design (15%)	$139,000
Oversight/Health and Safety (5%)	$46,000
TOTAL CAPITAL COSTS	$1,435,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Containment System	$35,000
Leachate Treatment System Sampling and Analysis (per sampling event)	$4,000
Leachate Sampling and Analysis (per sampling event)	$6,000
Multi-Phase Extraction in Source Areas	$83,000
TOTAL ANNUAL COSTS	$128,000
REPLACEMENT COSTS (2)	
Leachate Containment System (every 15 years)	$282,000
Monitoring Well Replacement (every 15 years)	$44,000
TOTAL REPLACEMENT COSTS	$326,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$1,435,000
Present Worth Annual O&M Costs (4)	$652,000
Leachate Treatment System Sampling	
Quarterly Sampling - years 1 through 30	$200,000
Leachate Sampling	
Quarterly Sampling - years 1 and 2	$44,000
Semi-annual Sampling - years 3 through 30	$145,000
Present Worth Replacement Costs (5)	$161,000
TOTAL PRESENT WORTH	$2,637,000

(1) Capital costs for construction items do not include oversight fees.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection for the Leachate Containment System and over a 3 year projection for the Multi-Phase Extraction System (Based on RCRA Closure Guidelines).
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells and leachate containment system (including central pump station, extraction wells, piping, pumps, and air stripping unit) every 15 years (twice over 30 year projection).

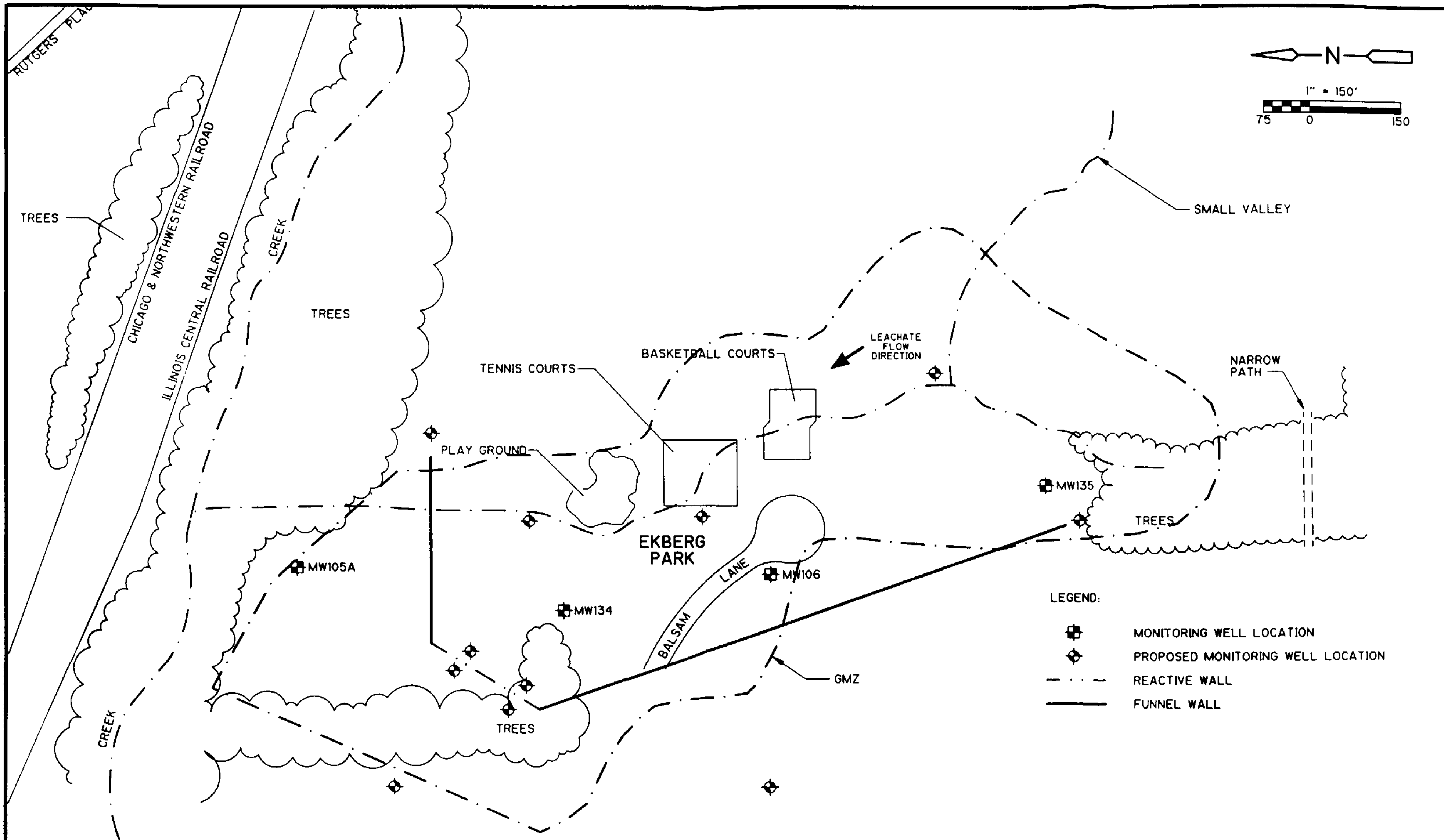

FIGURE No. 7-16
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 7
SOURCE CONTROL ALTERNATIVE SCL-7C

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Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The reactive barrier option also is protective of downgradient receptors of the GMZ since contaminated leachate is treated *in situ* prior to its discharge into the site-wide groundwater at the boundary of the GMZ. Therefore, the reactive barrier is protective of downgradient human health and the environment.

Compliance with ARARs

This alternative would comply with leachate ARARs at the boundary of the GMZ upon construction and operation although contaminant concentrations above MCLs would continue to exist in the site-wide groundwater. Implementing this alternative does effectuate treatment of the contaminant mass within the saturated soils and the leachate, such that the leachate passing from the GMZ into the site-wide groundwater will be below the MCLs.

Note that leachate above MCLs would continue to persist above MCLs independent of the soil remedy selected unless the excavation alternative was implemented, in which case the NAPL would be removed and leachate concentrations would likely decrease. Although leachate concentrations would drop, it is still likely that leachate would continue to contain constituents above MCLs for some time into the future.

Long-Term Effectiveness and Permanence

This alternative offers both long-term effectiveness and permanence for controlling the migration of leachate from the GMZ into site-wide groundwater. The reactive barrier technology can be operated reliably over relatively long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates, such that this treatment technology can control the migration of leachate from the GMZ into site-wide groundwater. Therefore, the reactive barrier is both effective and permanent.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the toxicity and volume of the contaminated leachate. By treating the contamination *in situ* as the leachate migrates across the GMZ boundaries, the contaminants are destroyed prior to their migration into downgradient areas. Therefore, this alternative effectively reduces the toxicity and volume of the leachate-borne contaminants.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant.

Implementability

The technologies associated with this alternative are proven and widely used in similar applications. However, the location of the trench is located near a drainage way, and structures or utilities would influence construction. As with any trench, underground utilities and dewatering also complicate construction. It is likely that these factors can be managed during design and construction of the reactive barrier, however there are issues that impact the implementability of this alternative that do not impact other alternatives.

Cost

The costs to implement Alternative SCL-7C are shown in **Table 7-23**. The total capital costs associated with this alternative are estimated at $4,104,000. Annual operation and maintenance costs are $8,000, and replacement costs are estimated at $97,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-7C would be approximately $4,391,000.

7.8 Detailed Analysis of Source Control Leachate Alternatives for Source Area 9/10

7.8.1 Alternative SCL-9/10A: No Action/Leachate Monitoring/ Groundwater Use Restrictions/Natural Attenuation

This alternative includes implementing institutional controls and a groundwater and leachate monitoring program. Institutional controls restricting groundwater usage would be recorded with the State and the City. Monitoring would be implemented by installing five additional monitoring wells - three within and two downgradient of the source area. These wells, along with one additional downgradient well, will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

TABLE 7-23

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
FOCUSED FEASIBILITY STUDY
ROCKFORD, ILLINOIS

AREA 7 - LEACHATE
ALTERNATIVE SCL-7C: REACTIVE BARRIER WALL / LEACHATE MONITORING/
GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Reactive Barrier Wall	$2,573,000
Leachate Monitoring Wells	$50,000
SUBTOTAL CONSTRUCTION COSTS (1)	$2,648,000
Bid Contingency (15%)	$397,000
Scope Contingency (20%)	$530,000
Engineering and Design (15%)	$397,000
Oversight/Health and Safety (5%)	$132,000
TOTAL CAPITAL COSTS	$4,104,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Sampling and Analysis (per event)	$8,000
TOTAL ANNUAL COSTS	$8,000
REPLACEMENT COSTS (1)	
Iron Rejuvenation (every 10 years)	$25,000
Monitoring Well Replacement (every 15 years)	$72,000
TOTAL REPLACEMENT COSTS	$97,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$4,104,000
Present Worth Annual O&M Costs (2)	
Quarterly Sampling - years 1 and 2	$59,000
Semi-annual Sampling - years 3 through 30	$170,000
Present Worth Replacement Costs (3)	$58,000
TOTAL PRESENT WORTH	$4,391,000

(1) Replacement costs include construction *and* oversight capital costs.
(2) Capital costs represent the present worth of the given alternative.
(3) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells every 15 years (twice over 30 year projection) and iron rejuvenation every 10 years (three times over 30 year projection).

Overall Protection of Human Health and the Environment

Implementing institutional controls will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. However, the No Action alternative is not necessarily protective of downgradient receptors because contaminants are allowed to migrate into the site-wide groundwater without control beyond that which is naturally occurring. Therefore, human and environmental receptors in downgradient locations are not protected from future contamination by the No Action alternative.

Note that if site-wide groundwater receptors are of adequate distance downgradient such that natural attenuation processes would reduce contaminant mass to protective levels given the declining concentrations of contaminants in the leachate, then the No Action alternative may be considered protective.

Compliance with ARARs

This alternative would not comply with ARARs for an extended period given that contaminant concentrations above MCLs would continue to migrate from the leachate into the site-wide groundwater. The length of time could not be predicted given the existence of data gaps. This condition would hold true independent of which soil remedial alternative is implemented. The length of time associated with the leachate exceeding MCLs would, however, be dependant upon the soil remedial alternative selected.

Long-Term Effectiveness and Permanence

The importance of long-term effectiveness and permanence with respect to managing downgradient risk under the No Action alternative will not be reliant upon the soil remediation strategy implemented. Independent of the selected soil alternative, the No Action alternative would not achieve any level of long-term effectiveness or permanence.

Note that institutional controls which are a component of the No Action alternative will provide an effective means by which to limit potential future exposures. Also note that these institutional controls will be permanent. However, these controls are a part of all the alternatives, and therefore, do not improve the long-term effectiveness or permanence of the No Action alternative with respect to the other alternatives.

Reduction of Toxicity, Mobility, and/or Volume through Treatment

Since the No Action alternative does not include any treatment of the leachate beyond that which is naturally occurring, this alternative would not reduce the toxicity, mobility, or volume of the contaminants in the leachate.

Short-Term Effectiveness

The No Action alternative does not provide any level of short-term effectiveness with regard to the source area leachate or the site-wide groundwater.

Implementability

Implementation of the No Action alternative will require that three tasks be performed, which are in fact part of all the other leachate alternatives. These tasks include install new monitoring wells, planning and implementing a new environmental monitoring program, and preparing the necessary papers for the deed recordation.

The construction of new monitoring wells is straightforward, given that the technologies to be used and the sampling methods are all well established. The potential difficulty in implementing the construction of the new monitoring wells will be in obtaining access to the proposed drilling sites. Although access can be obtained, it may take time for the proper access agreements to be negotiated. Planning and implementing the new sampling program can be performed readily. These types of programs have been put together before, and many examples exist from which to draw. Finally, the deed needs to be recorded with the State and other appropriate entities. The procedures for this type of activity are well established and can be followed without significant difficulty. Therefore, all of the proposed No Action alternative tasks can be implemented without significant difficulty.

Cost

The costs to implement Alternative SCL-9/10A are shown in **Table 7-24**. The total capital costs associated with this alternative are estimated at $60,000. Annual operation and maintenance costs are $3,000, and replacement costs are estimated at $29,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-9/10A would be approximately $217,000.

7.8.2 Alternative SCL-9/10B: Limited Action/Leachate Collection and Treatment by Air Stripping Unit/Discharge Treated Leachate at Off-site Surface Water/Groundwater Use Restrictions

This alternative combines the elements of the No Action alternative together with a hydraulic containment scenario to be implemented along the downgradient side of the GMZ. Hydraulic containment of the leachate at the GMZ boundary would be

TABLE 7-24

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

SOURCE AREA 9/10 - LEACHATE
ALTERNATIVE SCL-9/10A: NO ACTION / LEACHATE MONITORING / GROUNDWATER USE RESTRICTIONS/ NATURAL ATTENUATION
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Monitoring Wells	$18,000
SUBTOTAL CONSTRUCTION COSTS	**$43,000**
Bid Contingency (15%)	$6,000
Scope Contingency (20%)	$9,000
Oversight/Health and Safety (5%)	$2,000
TOTAL CAPITAL COSTS	**$60,000**
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Sampling and Analysis (per event)	$5,000
TOTAL ANNUAL COSTS	**$5,000**
REPLACEMENT COSTS (1)	
Monitoring Well Replacement (every 15 years)	$29,000
TOTAL REPLACEMENT COSTS	**$29,000**
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (2)	$60,000
Present Worth Annual O&M Costs (2)	
Leachate Sampling and Analysis	
Quarterly Sampling - years 1 and 2	$37,000
Semi-annual Sampling - years 3 through 30	$106,000
Present Worth Replacement Costs (3)	$14,000
TOTAL PRESENT WORTH	**$217,000**

(1) Replacement costs include construction *and* oversight capital costs.

(2) Capital costs represent the present worth of the given alternative.

(3) Present worth of replacement costs is based on a 7% annual discount rate and replacement of leachate monitoring wells every 15 years (twice over 30 year projection).

achieved through the construction of a limited groundwater pump and treat system. The groundwater would be extracted through a series of fifty extraction wells, treated using air stripping and discharged off site into neighboring surface waters. A schematic showing the alternative, including the proposed locations for the extraction wells, is presented in **Figure 7-17**.

Monitoring will be required during system operations to maintain permit compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs, as well as the standard NPDES permit monitoring requirements (i.e., total dissolved solids, nitrate, nitrite, phosphorous, etc.).

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing five additional monitoring wells - three within the GMZ and two downgradient of the GMZ. These wells, along with one additional downgradient well, will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines. These wells will also be instrumented to collect water level data on a semi-continuous rate to monitor extraction system performance.

It is anticipated that groundwater extraction activities will persist over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected.

Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The hydraulic containment option also is protective of downgradient receptors of the GMZ since contaminated leachate is contained at the boundary of the GMZ, and removed for treatment and discharge. Only those contaminants downgradient of the GMZ, within the site-wide groundwater, would impact downgradient receptors. To this end, the hydraulic containment option is protective of human health and the environment.

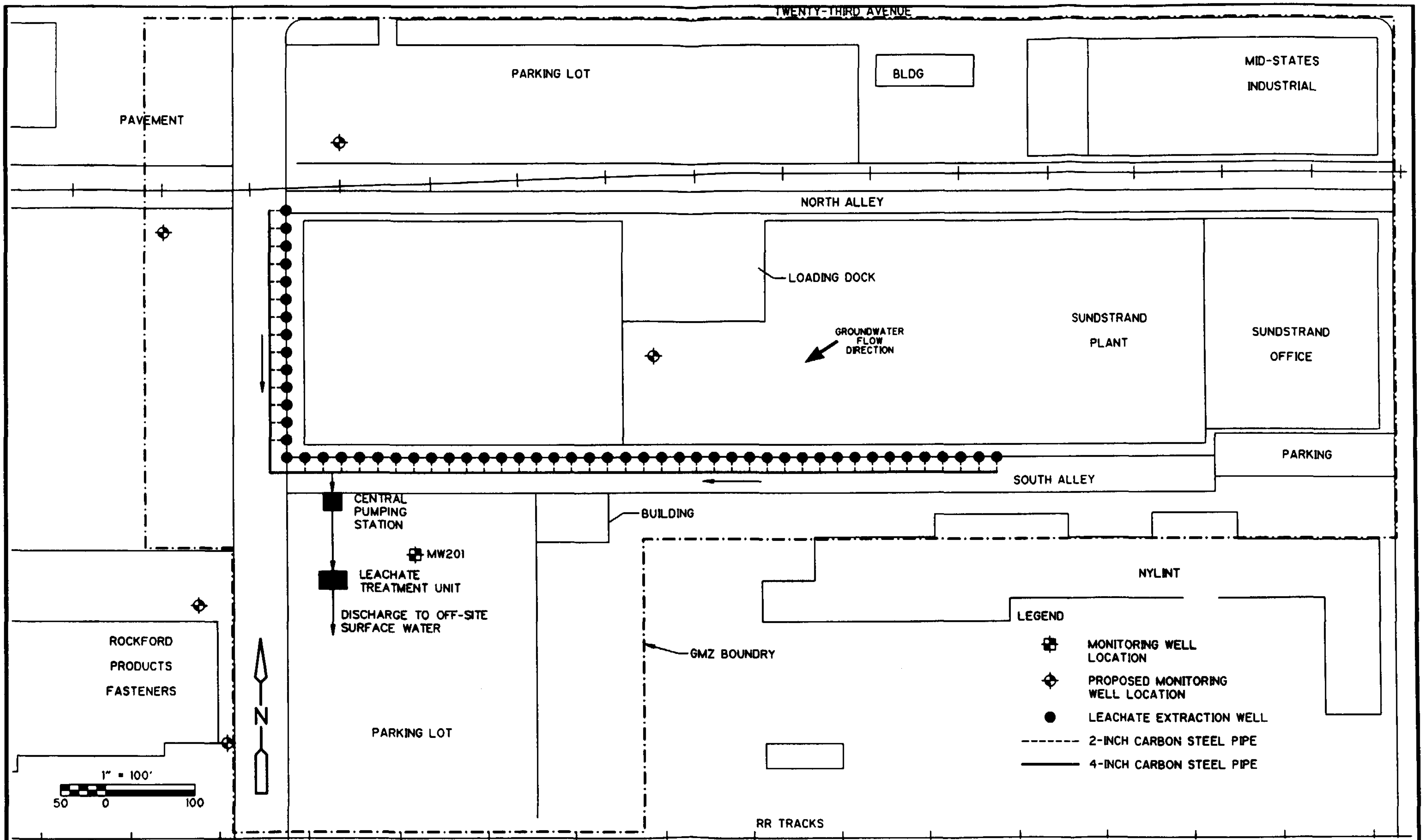

FIGURE No. 7-17
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 9/10
SOURCE CONTROL ALTERNATIVE SCL-9/10B

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Compliance with ARARs

This alternative would probably not comply with ARARs at the boundary of the GMZ for an extended period of time and contaminant concentrations above MCLs would continue to exist in the site-wide groundwater, however, this alternative would eliminate the continued migration of contaminants from the GMZ into site-wide groundwater, which meets one of the RAOs. Although continued operation of the groundwater extraction system would overtime reduce contaminant concentrations in the site-wide groundwater, it may take a significant amount of time for concentrations in the downgradient groundwater to decrease to MCLs or below.

This condition would hold true independent of which soil remedial alternative is implemented, since the soil remedy would only impact leachate concentrations within the GMZ. The length of time associated with the leachate exceeding MCLs would, however, be dependant upon the soil remedial alternative selected, but this would only impact leachate concentration within the GMZ. Note that there are no groundwater quality ARARs within the GMZ.

Long-Term Effectiveness and Permanence

This alternative offers both long-term effectiveness and permanence for containing the migration of leachate from the GMZ into site-wide groundwater. The groundwater extraction system is technology that can be operated over long periods of time and can effectively eliminate the downgradient migration of leachate across the GMZ boundary. This holds true independent of which soil remedy is selected.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the mobility of contaminant migration in the site-wide groundwater. By intercepting leachate as it migrates across the GMZ boundary, the contaminants are removed from the shallow flow system prior to their migration into downgradient areas. Therefore, this alternative effectively limits the mobility of the leachate-borne contaminants.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant.

Implementability

The technologies associated with this alternative are proven and widely used in similar applications. In addition, the proposed location of the wells and pipelines are in locations that are reasonably easy to access. Therefore, this alternative is considered relatively straightforward to implement.

The only difficult aspect of this alternative to implement may be the surface water discharge, since surface discharge permits often entail the control of constituents that are not related to the GMZ such as total dissolved solids or nutrients. Although this aspect of the alternative may not significantly impact the implementability of the alternative, it may make the alternative unimplementable.

Cost

The costs to implement Alternative SCL-9/10B are shown in **Table 7-25**. The total capital costs associated with this alternative are estimated at $1,326,000. Annual operation and maintenance costs are $42,000, and replacement costs are estimated at $797,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-9/10B would be approximately $2,440,000.

7.8.3 Alternative SCL-9/10C: Air Sparging along GMZ Boundary/Monitoring/Groundwater Use Restrictions

This alternative combines the elements of the Limited Action alternative together with an air sparging injection well system located downgradient along the boundary of the GMZ. The air sparge system would be constructed to strip groundwater of VOCs *in situ* through the injection of air. The gas and stripped solvents would be collected using vapor extraction wells. A pilot study will be conducted to determine the appropriate level of emissions control since limited data exists for this source area. For costing purposes, a carbon adsorption system has been assumed. A schematic showing the alternative, including the proposed locations for the sparge wells, is presented in **Figure 7-18**. Ten sparge wells and five vapor extraction wells will be located along the boundary of the GMZ.

Monitoring will be required during system operation to maintain air quality permitting compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs, only.

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

TABLE 7-25

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
FOCUSED FEASIBILITY STUDY
ROCKFORD, ILLINOIS

AREA 9/10 - LEACHATE
ALTERNATIVE SCL-9/10B: LEACHATE COLLECTION AND TREAT BY AIR STRIPPING UNIT / DISCHARGE TREATED LEACHATE AT OFF-SITE SURFACE WATER / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Containment System	$808,000
Leachate Monitoring Wells	$23,000
SUBTOTAL CONSTRUCTION COSTS (1)	$856,000
Bid Contingency (15%)	$128,000
Scope Contingency (20%)	$171,000
Engineering and Design (15%)	$128,000
Oversight/Health and Safety (5%)	$43,000
TOTAL CAPITAL COSTS	$1,326,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Containment System	$35,000
Leachate Treatment System Sampling and Analysis (per sampling event)	$4,000
Leachate Sampling and Analysis (per event)	$3,000
TOTAL ANNUAL COSTS	$42,000
REPLACEMENT COSTS (2)	
Leachate Containment System (every 15 years)	$768,000
Monitoring Well Replacement (every 15 years)	$29,000
TOTAL REPLACEMENT COSTS	$797,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$1,326,000
Present Worth Annual O&M Costs (4)	$434,000
Leachate Treatment System Sampling	
Quarterly Sampling - years 1 through 30	$200,000
Leachate Sampling	
Quarterly Sampling - years 1 and 2	$22,000
Semi-annual Sampling - years 3 through 30	$64,000
Present Worth Replacement Costs (5)	$394,000
TOTAL PRESENT WORTH	$2,440,000

(1) Capital costs for construction items do not include oversight fees.
(2) Replacement costs include construction *and* oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells and leachate containment system (including central pump station, extraction wells, piping, pumps, and air stripping unit) every 15 years (once over 30 year projection).

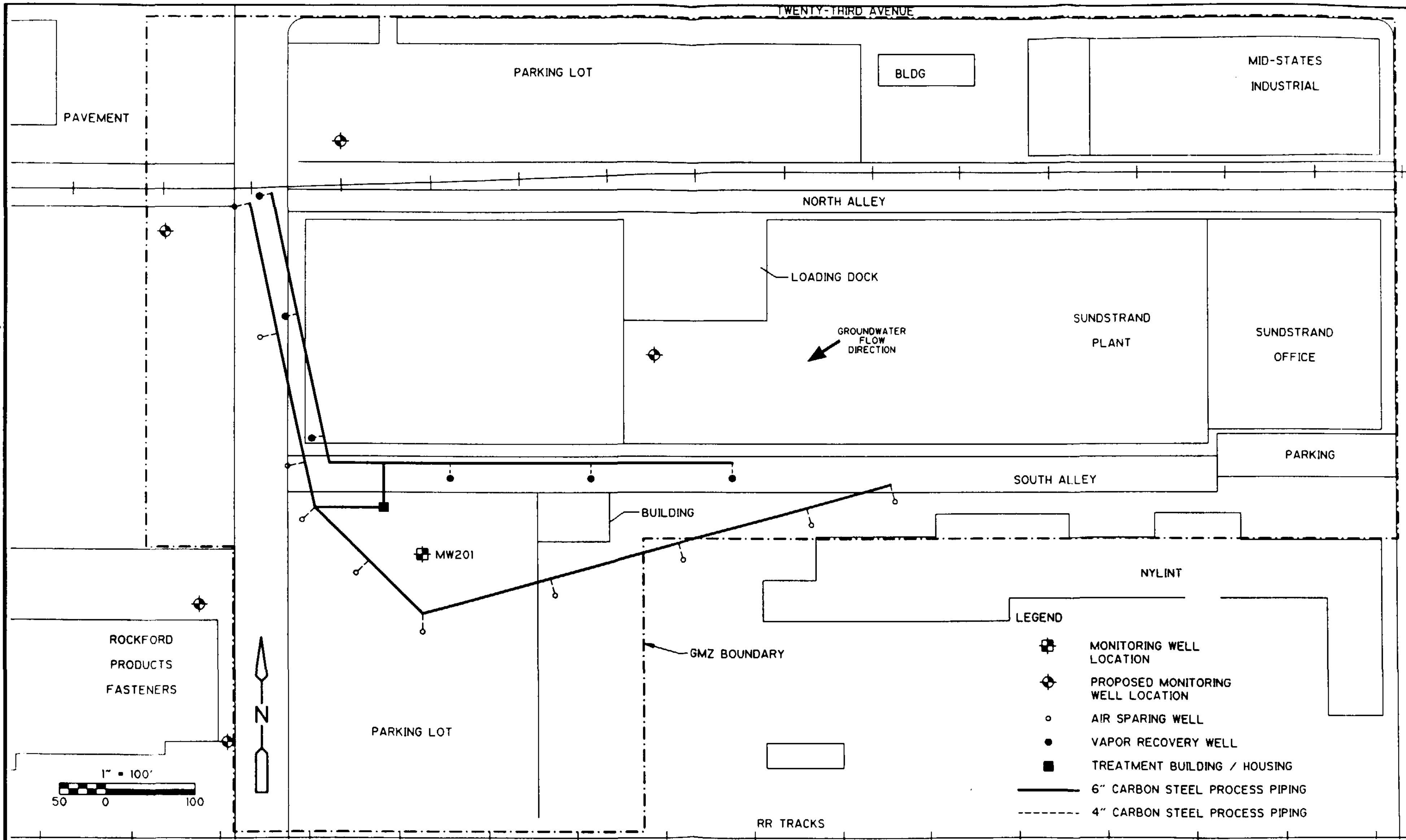

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FIGURE No. 7-18
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 9/10
SOURCE CONTROL ALTERNATIVE SCL-9/10C

As with the No Action alternative, groundwater monitoring would be implemented by installing five additional monitoring wells - three within the GMZ and two downgradient of the GMZ - as shown on Figure 7-18. These wells, along with one additional downgradient well, will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

It is anticipated that the air sparging activities will persist over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected.

Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The air sparging well point system is also protective of downgradient receptors of the GMZ since contaminated leachate is treated *in situ* prior to its discharge into the site-wide groundwater at the boundary of the GMZ. To this end, the air sparge alternative is protective of human health and the environment downgradient of the GMZ.

Compliance with ARARs

This alternative would eventually comply with ARARs at the boundary of the GMZ after and extended period although given that contaminant concentrations above MCLs would be treated to below MCLs as leachate passes through the well point system prior to discharging to site-wide groundwater. In this way, this alternative eliminates the continued migration of contaminants from the GMZ into site-wide groundwater. Implementing this alternative does effectuate treatment of the contaminant mass within the saturated soils and the leachate at those areas adjacent to the well point system, however, beneath the source areas are not treated directly such that the contaminant mass would be depleted only through source control activities or via natural processes. Therefore, it will be on the order of decades to centuries before the leachate within the GMZ will be below the MCLs.

Long-Term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of leachate from the GMZ into site-wide groundwater. The air sparge technology can be operated reliably over long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates. Since the treatment system has been placed at the downgradient boundary of the GMZ, the air sparge system will control the migration of leachate from the GMZ into site-wide groundwater. Therefore, this treatment system does offer complete long-term effectiveness in meeting the RAOs.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the mobility of the contaminated leachate. By stripping the contamination from the leachate as it migrates across the hot spots within the GMZ, the contaminants are removed from the shallow flow system prior to their migration into downgradient areas. Therefore, this alternative effectively limits the mobility of the leachate-borne contaminants.

Contaminated vapors extracted via the SVE system will be treated in a catalytic oxidation unit, therefore a reduction in contaminant toxicity and volume will be realized through the implementation of this alternative.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant.

Implementability

The technologies associated with this alternative are proven and widely used in similar applications. In addition, the proposed location of the wells and pipelines are reasonably easy to access. Therefore, this alternative is considered relatively straightforward to implement.

Cost

The costs to implement Alternative SCL-9/10C are shown in **Table 7-26**. The total capital costs associated with this alternative are estimated at $2,293,000. Annual operation and maintenance costs are $65,000, and replacement costs are estimated at $44,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-9/10C would be approximately $3,208,000.

TABLE 7-26
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

SOURCE AREA 9/10
ALTERNATIVE SCL-9/10C: AIR SPARGING (AS) ALONG GMZ BOUNDARY / MONITORING / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

	Item/Description	Total Cost
CAPITAL COSTS		
	Groundwater Use Restrictions	$25,000
	General	$1,038,000
	Leachate Monitoring Wells	$23,000
	VRS	$232,000
	Air Sparging	$161,000
	SUBTOTAL CONSTRUCTION COSTS (1)	$1,479,000
	Bid Contingency (15%)	$222,000
	Scope Contingency (20%)	$296,000
	Engineering and Design (15%)	$222,000
	Oversight/Health and Safety (5%)	$74,000
	TOTAL CAPITAL COSTS	$2,293,000
ANNUAL OPERATING AND MAINTENANCE COSTS		
	Leachate Sampling and Analysis (per event)	$3,000
	VRS Regular Maintenance/Electrical	$26,000
	Regular System Maintenance/Electrical	$36,000
	TOTAL ANNUAL COSTS	$65,000
REPLACEMENT COSTS		
	Monitoring Wells (every 15 years)	$29,000
	Equipment Replacement (e.g., motors, blowers) - every 15 years	$15,000
	TOTAL REPLACEMENT COSTS (2)	$44,000
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$2,293,000
	Present Worth Annual O&M Costs (4)	$807,000
	Leachate Sampling	
	Quarterly Sampling - years 1 and 2	$22,000
	Semi-annual Sampling - years 3 through 30	$64,000
	Present Worth Replacement Costs (5)	$22,000
	TOTAL PRESENT WORTH	$3,208,000

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of system equipment and leachate monitoring wells every 15 years (once over 30 year projection).

7.8.4 Alternative SCL-9/10D: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

This alternative combines the elements of the No Action alternative together with a funnel and gate reactive barrier scenario to be constructed at the downgradient boundary of the GMZ. The reactive barrier system would be constructed to treat the leachate of VOCs *in situ* as it leaves the GMZ through the reactive gate. A schematic showing the alternative is presented in **Figure 7-19.**

Monitoring will be required during use of the wall to characterize compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs. This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing five additional monitoring wells - three within the GMZ and two downgradient of the GMZ - as shown on **Figure 7-19.** These wells, along with one additional downgradient well, will be sampled for VOCs on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

It is anticipated that the reactive barrier will be used over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected.

Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The reactive barrier option is also protective of downgradient receptors of the GMZ since contaminated leachate is treated *in situ* prior to its discharge into the site-wide groundwater at the boundary of the GMZ. Therefore, the reactive barrier is protective of downgradient human health and the environment.

Compliance with ARARs

This alternative would comply with ARARs at the boundary of the GMZ, concentrations above MCLs would continue to exist in the site-wide groundwater. Upon construction and operation although this alternative does eliminate the continued migration of contaminants from the GMZ into site-wide groundwater.

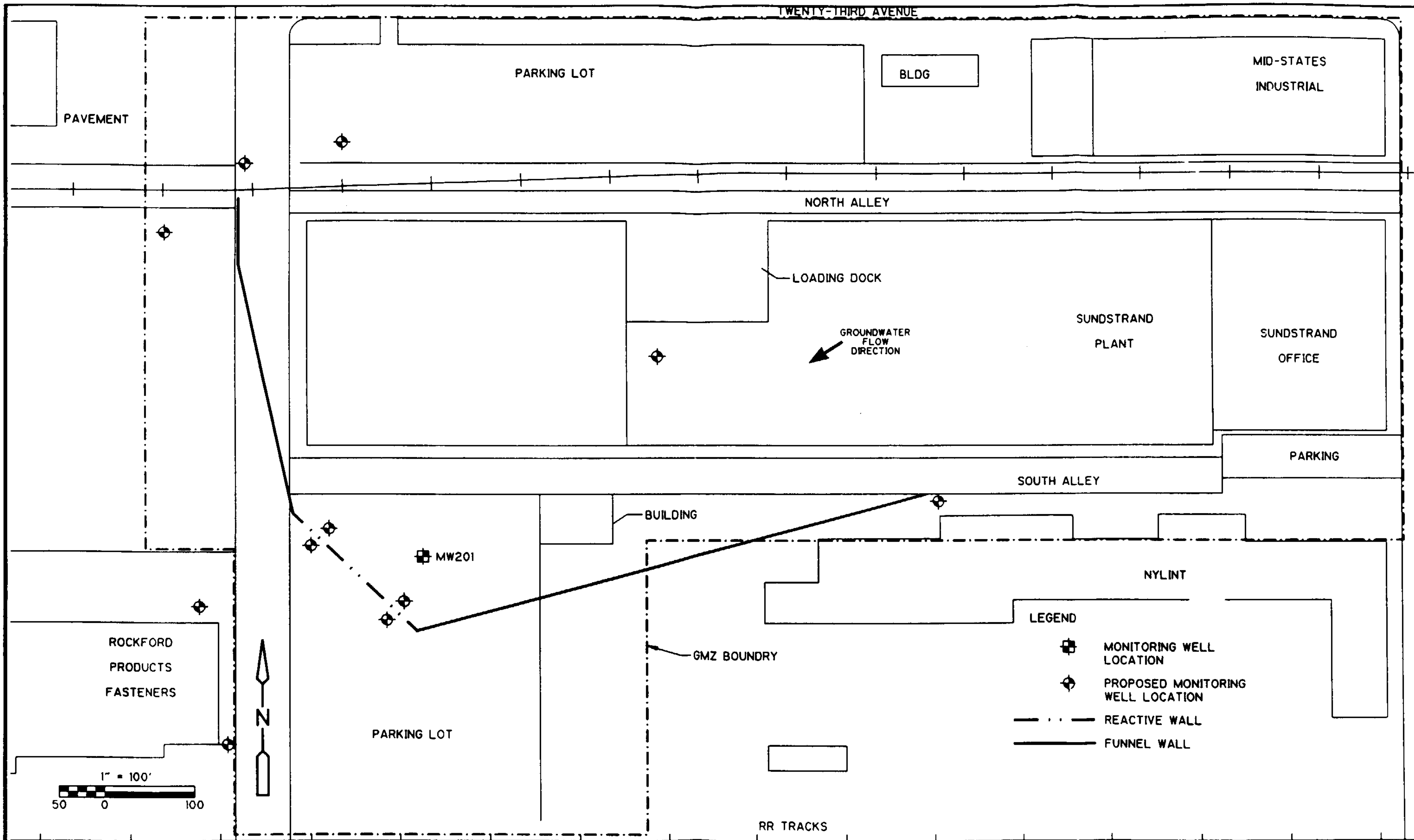

FIGURE No. 7-19
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 9/10
SOURCE CONTROL ALTERNATIVE SCL-9/10D

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Implementing this alternative does effectuate treatment of the contaminant mass within the saturated soils and the leachate, such that the leachate passing from the GMZ into the site-wide groundwater will be below the MCLs.

Long-Term Effectiveness and Permanence

This alternative offers both long-term effectiveness and permanence for controlling the migration of leachate from the GMZ into site-wide groundwater. The reactive barrier technology can be operated reliably over relatively long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates, such that this treatment technology can control the migration of leachate from the GMZ into site-wide groundwater. Therefore, the reactive barrier is both effective and permanent.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the toxicity and volume of the contaminated leachate. By treating the contamination *in situ* as the leachate migrates across the GMZ boundaries, the contaminants are destroyed prior to their migration into downgradient areas. Therefore, this alternative effectively reduces the toxicity and volume of the leachate-borne contaminants.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant.

Implementability

The technologies associated with this alternative are proven and have been used in similar applications. As with any trench, underground utilities, nearby structures, a confined construction area, and dewatering complicate construction. It is likely that these factors can be managed during design and construction of the reactive barrier, however there are issues that impact the implementability of this alternative that do not impact other alternatives.

Cost

The costs to implement Alternative SCL-9/10D are shown in **Table 7-27**. The total capital costs associated with this alternative are estimated at $3,329,000. Annual operation and maintenance costs are $5,000, and replacement costs are estimated at $83,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-9/10D would be approximately $3,523,000.

7.8.5 Alternative SCL-9/10E: Air Sparging along GMZ Boundary and Source Area/Monitoring/Groundwater Use Restrictions

This alternative combines the elements of the No Action alternative together with an air sparging scenario to be implemented in the source area and within the boundary of the GMZ. Air sparging which can only be implemented along with the soil remedy of SVE would be achieved through the construction of an air sparge system of wells and blowers. The air sparge system would be constructed to strip groundwater within the GMZ of VOCs *in situ* through the injection of air into specially designed well bubblers. The gas and stripped solvents would be collected in the SVE system above the water table to protect human health and the environment. A schematic showing the alternative, including the proposed locations for the sparge wells, is presented in **Figure 7-20.** Ten air sparge wells and five vapor extraction wells will be installed at the GMZ boundary similar to alternative SCL-4C, however for this alternative five sparge wells will be installed at the source area and operated with the SVE system for source control alternative SCS-9/10C. A pilot study will be conducted to determine the appropriate level of emissions control since limited data exists for this source area. For costing purposes, a carbon adsorption system has been assumed.

Monitoring will be required during system operations to maintain air quality permitting compliance and to evaluate treatment system efficiency. For this reason, system monitoring will include VOCs, only.

This alternative also includes implementing institutional controls within the GMZ and groundwater monitoring both interior to and beyond the limits of the GMZ. Institutional controls would be implemented through recording the GMZ with the State of Illinois, and deed recording the GMZ with the State and the City.

As with the No Action alternative, groundwater monitoring would be implemented by installing five additional monitoring wells - three within the GMZ and two downgradient of the GMZ. These wells, along with two additional downgradient well, will be sampled for VOCs and bioparameters on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

TABLE 7-27

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
FOCUSED FEASIBILITY STUDY
ROCKFORD, ILLINOIS

AREA 9/10 - LEACHATE
ALTERNATIVE SCL-9/10D: REACTIVE BARRIER WALL / LEACHATE MONITORING/ GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Reactive Barrier Wall	$2,073,000
Leachate Monitoring Wells	$50,000
SUBTOTAL CONSTRUCTION COSTS (1)	$2,148,000
Bid Contingency (15%)	$322,000
Scope Contingency (20%)	$430,000
Engineering and Design (15%)	$322,000
Oversight/Health and Safety (5%)	$107,000
TOTAL CAPITAL COSTS	$3,329,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Sampling and Analysis (per event)	$5,000
TOTAL ANNUAL COSTS	$5,000
REPLACEMENT COSTS (1)	
Iron Replacement (every 10 years)	$25,000
Monitoring Well Replacement (every 15 years)	$58,000
TOTAL REPLACEMENT COSTS	$83,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$3,329,000
Present Worth Annual O&M Costs (2)	
Quarterly Sampling - years 1 and 2	$37,000
Semi-annual Sampling - years 3 through 30	$106,000
Present Worth Replacement Costs (3)	$51,000
TOTAL PRESENT WORTH	$3,523,000

(1) Replacement costs include construction *and* oversight capital costs.
(2) Capital costs represent the present worth of the given alternative.
(3) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells every 15 years (once over 30 year projection) and iron replacement every 10 years (twice over 30 year projection).

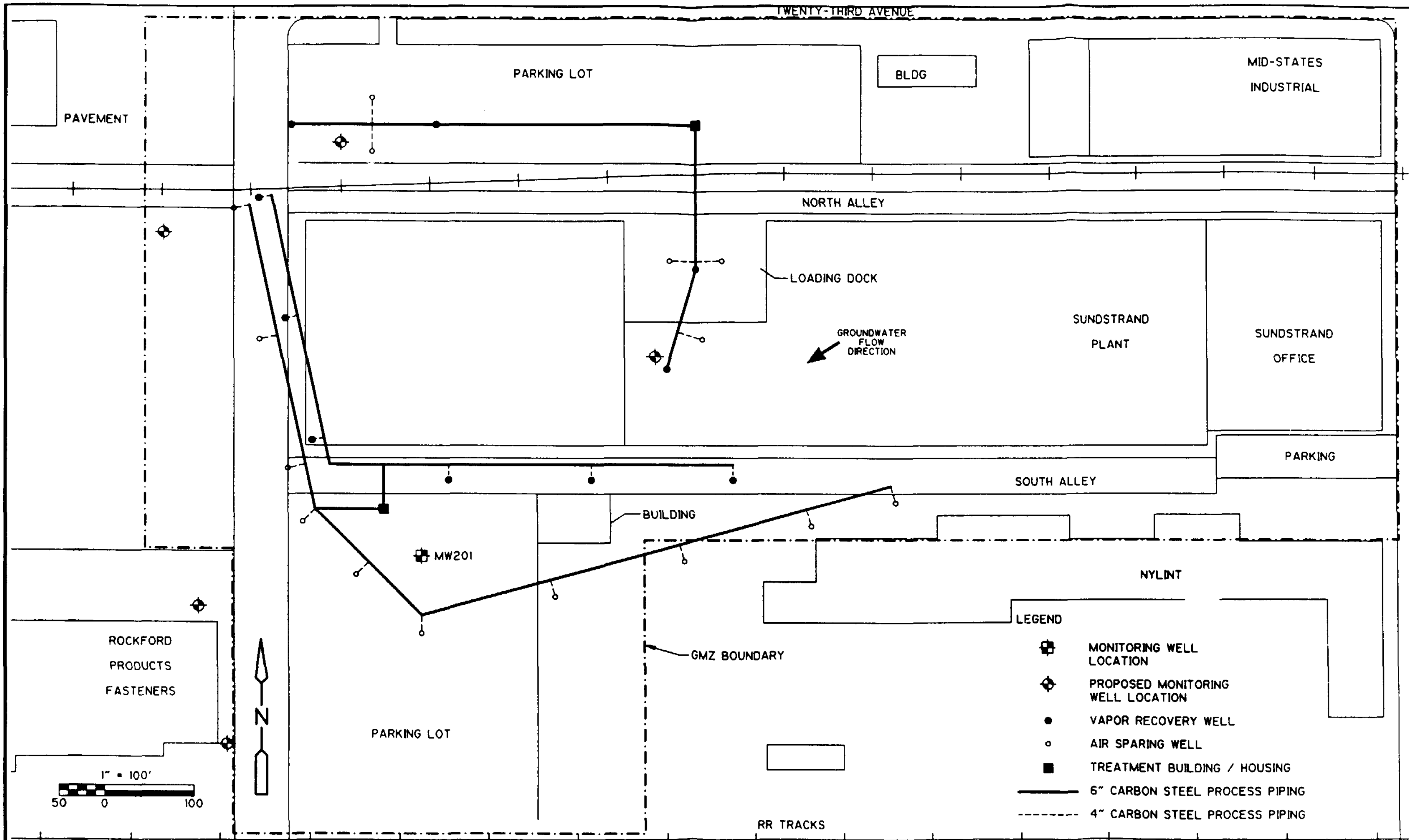

FIGURE No. 7-20
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
LEACHATE SCHEMATIC LAYOUT FOR AREA 9/10
SOURCE CONTROL ALTERNATIVE SCL-9/10E

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It is anticipated that the air sparging activities will persist over the entire 30 years of the planning horizon used for costing in the FFS. This assumption is independent of the type of soil remedy selected.

Overall Protection of Human Health and the Environment

As discussed under the No Action alternative, implementing institutional controls within the boundaries of the GMZ will be protective of human health with respect to the prevention of humans contacting the leachate, and generally using the groundwater. The air sparging option is also protective of downgradient receptors of the GMZ since contaminated leachate is treated *in situ* prior to its discharge into the site-wide groundwater at the boundary of the GMZ. Further, this air sparge alternative addresses the leachate within the GMZ. To this end, the air sparge alternative protects human health and the environment downgradient of the GMZ.

Compliance with ARARs

This alternative would eventually comply with ARARs at the boundary of the GMZ given that treatment will also occur at the source, therefore reducing the migration of contaminants from the GMZ into site-wide groundwater. Implementing this alternative does effectuate treatment of the contaminant mass within the saturated soils and the leachate, such that eventually the leachate within the GMZ will be below the MCL. Again note that air sparging must be conducted with the SVE soil remedy to control off gas and protect human health near the source areas.

Long-Term Effectiveness and Permanence

This alternative offers long-term effectiveness and permanence for controlling the migration of leachate from the GMZ into site-wide groundwater. The air sparge system is a technology that can be operated reliably over long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates. Therefore, the air sparge system does offer complete long-term effectiveness in meeting the RAOs.

Note that institutional controls which are a component of this alternative will provide an effective means by which to limit potential future exposures within the GMZ. Also note that these institutional controls are permanent.

Reduction of Toxicity, Mobility, and/or Volume

This alternative directly effects the mobility of the contaminated leachate. By stripping the contamination from the leachate as it migrates across the hot spots within the GMZ, the contaminants are removed from the shallow flow system prior to their migration into downgradient areas. Therefore, this alternative effectively limits the mobility of the leachate-borne contaminants.

Short-Term Effectiveness

In the short term, construction workers and drillers may be exposed to the contaminants found within the leachate, however, this exposure would be limited to only those periods of time during construction. It is anticipated that the exposure scenarios associated with the construction workers, etc. would not be significant.

Implementability

The technologies associated with this alternative are proven and widely used in similar applications. In addition, the proposed location of the wells and pipelines are in locations that are reasonably easy to access. Therefore, this alternative is considered relatively straightforward to implement.

Cost

The costs to implement Alternative SCL-9/10E are shown in **Table 7-28**. The total capital costs associated with this alternative are estimated at $2,697,000. Annual operation and maintenance costs are $65,000, and replacement costs are estimated at $59,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-9/10E would be approximately $3,619,000. Note that since it is expected that the source control alternative to be implemented will be SVE, the costs to place vapor extraction wells in the source area and emissions control are not included in the overall costs of this alternative. If SVE is not implemented, then these costs will have to added.

7.9 Detailed Analysis of Source Control Leachate Alternatives for Source Area 11

The results of the fate and transport analysis indicated that groundwater ARARs would be attained for all contaminants of concern within the GMZ boundary under the No Action scenario. However, Alternative SCL-11A - No action was developed and evaluated within this section according to seven of the nine NCP criteria to document the alternatives compliance with CERCLA.

7.9.1 Alternative SCL-11A: No Action/Leachate Monitoring/ Natural Attenuation/Groundwater Use Restrictions

This alternative includes implementing institutional controls and a groundwater and leachate monitoring program. Institutional controls restricting groundwater usage would be recorded with the State and the City. Monitoring would be implemented by installing four additional monitoring wells - two within and two downgradient of the source area. These wells, along with two additional existing wells, will be sampled for VOCs on a quarterly sampling program for 2 years followed by a semiannual program for years 3 through 30, based on RCRA closure guidelines.

TABLE 7-28
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

SOURCE AREA 9/10
ALTERNATIVE SCL-9/10E: AIR SPARGING (AS) ALONG GMZ BOUNDARY AND SOURCE AREA / MONITORING / GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description		Total Cost
CAPITAL COSTS		
	Groundwater Use Restrictions	$25,000
	General	$1,038,000
	Lechate Monitoring Wells	$23,000
	VRS	$423,000
	Air Sparging	$231,000
	SUBTOTAL CONSTRUCTION COSTS (1)	$1,740,000
	Bid Contingency (15%)	$261,000
	Scope Contingency (20%)	$348,000
	Engineering and Design (15%)	$261,000
	Oversight/Health and Safety (5%)	$87,000
	TOTAL CAPITAL COSTS	$2,697,000
ANNUAL OPERATING AND MAINTENANCE COSTS		
	VRS Regular Maintenance/Electrical	$26,000
	Leachate Sampling and Analysis (per event)	$3,000
	Regular System Maintenance/Electrical	$36,000
	TOTAL ANNUAL COSTS	$65,000
REPLACEMENT COSTS		
	Leachate Monitoring Wells (every 15 years)	$29,000
	Equipment Replacement (e.g., motors, blowers) - every 15 years	$30,000
	TOTAL REPLACEMENT COSTS (2)	$59,000
PRESENT WORTH ANALYSIS		
	Total Capital Costs (from above) (3)	$2,697,000
	Present Worth Annual O&M Costs (4)	$807,000
	Leachate Sampling	
	Quarterly Sampling - years 1 and 2	$22,000
	Semi-annual Sampling - years 3 through 30	$64,000
	Present Worth Replacement Costs (5)	$29,000
	TOTAL PRESENT WORTH	$3,619,000

(1) Capital costs for construction items do not include oversight fees, which are accounted for separately.
(2) Replacement costs include construction and oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) Present worth of annual O&M costs is based on a 7% discount rate over a life of 30 years.
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of system equipment every 15 years (once over 30 year projection).

Overall Protection of Human Health and the Environment

Implementing institutional controls (groundwater use restrictions) will be protective of human health and the environment. The results of the fate and transport analysis for Area 11 indicate that BETX are naturally attenuated before they reach the GMZ located 150 feet downgradient of the Area 11.

Compliance with ARARs

Based on the results of the fate and transport analysis, this alternative would comply with ARARs at the GMZ boundary.

Long-Term Effectiveness and Permanence

No Action alternative would provide a risk level of long-term effectiveness or permanence. The results of the fate and transport analysis for Area 11 indicate that BETX are naturally attenuated before they reach the GMZ located 150 feet downgradient of the Area 11.

Reduction of Toxicity, Mobility or Volume through Treatment

Since the No Action alternative does not include any treatment of the leachate beyond that which is naturally occurring, this alternative would not reduce the toxicity, mobility, or volume of the contaminants in the leachate.

Short-Term Effectiveness

The No Action alternative would provide a high level of short-term effectiveness with regard to the source area leachate or the site-wide groundwater.

Implementability

Implementation of the No Action alternative will require that three tasks be performed, which are in fact part of all the other leachate alternatives. These tasks include the installation of new monitoring wells, planning and implementing a new environmental monitoring program, and preparing the necessary papers for the deed for recording the deed restrictions.

The construction of new monitoring wells is straightforward, given that the technologies to be used and the sampling methods are all well established. The potential difficulty in implementing the construction of the new monitoring wells will be in obtaining access to the proposed drilling sites. Planning and implementing the new sampling program can be performed readily. These types of programs have been put together before, and many examples exist from which to draw. Finally, the deed needs to be recorded with the State and other appropriate entities. The procedures for this type of activity are well established and can be followed without significant difficulty. Therefore, all of the proposed No Action alternative tasks can be implemented without significant difficulty.

Cost

The costs to implement Alternative SCL-11A are shown in **Table 7-29**. The total capital costs associated with this alternative are estimated at $54,000. Annual operation and maintenance costs are $8,000, and replacement costs are estimated at $29,000. Assuming a discount rate of seven percent, the net present worth of Alternative SCL-11A would be approximately $297,000.

TABLE 7-29

SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS
FOCUSED FEASIBILITY STUDY

SOURCE AREA 11 - LEACHATE
ALTERNATIVE SCL-11A: NO ACTION / LEACHATE MONITORING/ NATURAL ATTENUATION/ GROUNDWATER USE RESTRICTIONS
COST SUMMARY

Item/Description	Total Cost
CAPITAL COSTS	
Groundwater Use Restrictions	$25,000
Leachate Monitoring Wells	$18,000
SUBTOTAL CONSTRUCTION COSTS	$43,000
Bid and Scope Contingency (20%)	$9,000
Oversight/Health and Safety (5%)	$2,000
TOTAL CAPITAL COSTS (1)	$54,000
ANNUAL OPERATING AND MAINTENANCE COSTS	
Leachate Sampling and Analysis (per event)	$8,000
TOTAL ANNUAL COSTS	$8,000
REPLACEMENT COSTS (2)	
Monitoring Well Replacement (every 15 years)	$29,000
TOTAL REPLACEMENT COSTS	$29,000
PRESENT WORTH ANALYSIS	
Total Capital Costs (from above) (3)	$54,000
Present Worth Annual O&M Costs (4)	
Leachate Sampling	
Quarterly Sampling - years 1 and 2	$59,000
Semi-annual Sampling - years 3 through 30	$170,000
Present Worth Replacement Costs (5)	$14,000
TOTAL PRESENT WORTH	$297,000

(1) Capital costs for construction items do not include oversight fees.
(2) Replacement costs include construction *and* oversight capital costs.
(3) Capital costs represent the present worth of the given alternative.
(4) The "Present Worth Annual O&M Cost" line item includes all annual costs except for costs per sampling and analysis event. Costs incurred for sampling and analysis are broken down per sampling schedule as listed. Sampling and analysis costs are based on a 7% discount rate over a 30 year projection (Based on RCRA Closure Guidelines).
(5) Present worth of replacement costs is based on a 7% annual discount rate and replacement of monitoring wells replacement every 15 years.

Section 8
Comparison of Alternatives

This section summarizes the performance of each of the source control soil and source control leachate remedial alternatives relative to the seven NCP evaluation criteria. The following subsections present an overview of the protectiveness achieved by each alternative for each of the source areas. Alternative SCL-11A: No Action is not included within this section because it was the only alternative developed for leachate at Area 11.

8.1 Source Control Soil Area 4

The relative performance of each of the source control remedial alternatives for Source Area 4 is summarized in **Table 8-1**. The intended future land use for this source area was assumed to be residential. Each of these alternatives is discussed in greater detail in the following subsections.

8.1.1 Alternative SCS-4A: No Action

No actions would be taken for this alternative. This alternative would provide no additional protection to human health or the environment. Contaminants in the soils would continue to migrate away from the source area with contaminant concentrations reduced to acceptable levels only through natural attenuation mechanisms.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a significant period of time (up to 70 years). Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with no associated costs to implement.

8.1.2 Alternative SCS-4B: Limited Action - Deed Restrictions

This alternative would provide a limited level of protection to human health and the environment from contaminated soils. Contaminants in the soils would continue to migrate away from the source area until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms. However, restrictions placed on land use would minimize future uses of the area that could lead to exposure to contaminants.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a significant period of time (up to 70

TABLE 8-1
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL SOIL ALTERNATIVES FOR SOURCE AREA 4

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCS-4A: No Action	**No** Not protective of human health or the environment, except through natural attenuation.	**No** ARARs not attained.	**Low** No level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** No remedial actions take place under this alternative.	**$0**
SCS-4B: Limited Action-Deed Restrictions	**No** Somewhat protective of human health. Not protective of the environment. Requires maintenance to be effective.	**No** ARARs not attained.	**Low** Minimal level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** Administratively easy to implement if property owners comply.	**$28,000**
SCS-4C: Soil Vapor Extraction /Catalytic Oxidation	**Yes** Protective of human health and the environment. Reduces the mass of contaminants.	**Yes** Complies with soil ARARs within a reasonable time frame.	**Medium** Does mitigate further contaminant releases to groundwater. SVE is a well-demonstrated technology for the removal of VOCs.	**Medium** Significant reduction of toxicity, mobility and volume could be realized, however, residual NAPL could provide a continuing source of contaminants.	**Medium/High** Minimal risks to on-site workers and the surrounding community. The time frame for protection of human health and the environment is reasonable.	**Medium/High** Technically easy to implement.	**$2,012,000**
SCS-4D: Excavation and On-Site Thermal Treatment	**Yes** Eliminates risks associated with source material in less than 1 year.	**Yes** Complies with soil ARARs.	**High** Permanent Solution. Does not require long-term maintenance. Contaminants are thermally desorbed from soils.	**Medium/High** Eliminates mobility, toxicity, or volume of VOCs. Will not address contamination underneath building. Meets the regulatory preference to utilize treatment-based remedies.	**Medium** VOCs released during excavation and treatment can be effectively controlled. Eliminates risks associated with source material in less than 1 year.	**Medium** Technically easy to implement. There are space considerations and administrative delays associated with implementation.	**$1,719,000**

years). Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with minimal costs to implement.

8.1.3 Alternative SCS-4C: Soil Vapor Extraction/Catalytic Oxidation

This alternative would provide a better degree of protection to human health and the environment by reducing the mass of contaminants available to leach from soils to eventually site-wide groundwater. Overall, the soil vapor extraction technology is easily implementable, and would result in minimal disturbance to the community and the surrounding area.

This alternative would comply with soil ARARs given that contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated. However, residual NAPL could provide a continuing source of contaminants. Leachate ARARs would be achieved at the GMZ boundary in 20 to 30 years. Costs to implement this alternative are the highest for the source control alternatives for this source area.

8.1.4 Alternative SCS-4D: Excavation and On-Site Thermal Treatment

This alternative would provide the highest level of protection to human health and the environment. Under this alternative, contaminated soils above clean-up goals would be excavated and treated on site. Leachate ARARs would be achieved at the GMZ boundary in 5 to 15 years. This alternative meets the regulatory preference to utilize treatment-based remedies. Long-term effectiveness and permanence and the reduction of toxicity, mobility or volume are rated high for this alternative. However, there may be administrative delays in the implementation of this alternative.

VOCs released during excavation can be effectively controlled such that there are no adverse impacts to public health. The costs to implement this alternative are similar to the soil vapor extraction alternative, but with a higher overall rating for protection of human health and the environment.

8.2 Source Control Soil Area 7

The relative performance of each of the source control remedial alternatives for Area 7 is summarized in **Table 8-2**. The intended future land use for this source area was assumed to be residential. Each of these alternatives is discussed in greater detail in the following subsections.

TABLE 8-2
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL SOIL ALTERNATIVES FOR SOURCE AREA 7

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCS-7A: No Action	**No** Not protective of human health or the environment, except through natural attenuation.	**No** ARARs not attained.	**Low** No level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** No remedial actions take place under this alternative.	**$0**
SCS-7B: Limited Action-Park Demolition, Access and Deed Restrictions	**No** Somewhat protective of human health. Not protective of the environment. Requires maintenance to be effective.	**No** ARARs not attained.	**Low** Minimal level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**High** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** Administratively easy to implement if property owners comply.	**$275,000**
SCS-7C: Excavation and On-Site Biological Treatment/ Recreational Facilities	**Yes** Eliminates risks associated with source material in two years.	**Yes** Complies with soil ARARs within a reasonable time frame	**Medium/High** Permanent Solution. Does not require long-term maintenance. Effective and reliable over the long-term as the process will permanently remove the contaminants from soils.	**Medium/High** Eliminates mobility, toxicity, or volume of VOCs. Meets the regulatory preference to utilize treatment-based remedies	**Medium** VOCs released during excavation and treatment can be effectively controlled. Eliminates risks associated with source material in two years.	**Medium** Technically easy to implement.	**$18,218,000**
SCS-7D: Excavation and On-Site Thermal Treatment/ Recreational Facilities Replacement	**Yes** Eliminates risks associated with source material in less than 1 year.	**Yes** Complies with soil ARARs.	**High** Permanent Solution. Does not require long-term maintenance. Contaminants are thermally desorbed from soils.	**High** Eliminates mobility, toxicity, or volume of VOCs. Meets the regulatory preference to utilize treatment-based remedies	**Medium/High** VOCs released during excavation and treatment can be effectively controlled. Eliminates risks associated with source material in less than 1 year	**Medium** Technically easy to implement. Possible space considerations and administrative delays with implementation	**$15,209,000**
SCS-7E: Soil Vapor Excavation / Air Sparging/ Monitoring/ Groundwater Use Restrictions/ Catalytic Oxidation	**Yes** Protective of human health and the environment. Reduces the mass of contaminants	**Yes** Complies with soil ARARs within a reasonable time frame	**Medium** Does mitigate further contaminant releases to leachate. SVE/AS are reliable and well demonstrated technologies for the removal of VOCs	**Medium** Moderate reduction of toxicity, mobility and volume could be realized of unsaturated and saturated soil and leachate	**Medium/High** Minimal risks to onsite workers Moderate disturbance to community and surrounding area. Protection of human health and the environment can be achieved in an acceptable timeframe	**Medium/High** Technically feasible.	**$5,624,000**

8.2.1 Alternative SCS-7A: No Action

No actions would be taken for this alternative. This alternative would provide no additional protection to human health or the environment. Contaminants in the soils would continue to migrate away from the source area with contaminant concentrations reduced to acceptable levels only through natural attenuation mechanisms.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a significant period of time (up to 90 years). Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with no associated costs to implement.

8.2.2 Alternative SCS-7B: Limited Action - Park Demolition, Access and Deed Restrictions

This alternative would provide a limited level of protection to human health and the environment from contaminated soils. Contaminants in the soils would continue to migrate away from the source area until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms. However, restrictions placed on land use would minimize future uses of the area that could lead to exposure to contaminants.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a significant period of time (up to 90 years). Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with minimal costs to implement.

8.2.3 Alternative SCS-7C: Excavation and On-site Biological Treatment/Recreational Facilities

This alternative would provide a high level of protection to human health and the environment. Under this alternative, contaminated soils above clean-up goals would be excavated and treated on site. It is expected that ARARs would not be met for a period of up to 25 years. This alternative meets the regulatory preference to utilize treatment-based remedies. Long-term effectiveness and permanence and the reduction of toxicity, mobility or volume are rated high for this alternative. VOCs released during excavation can be effectively controlled such that there are no adverse impacts to public health.

The costs to implement this alternative are high and the treatment time is longer for excavation and on-site biological treatment than for thermal treatment. However, this alternative may be easier to implement and more acceptable to the community.

8.2.4 Alternative SCS-7D: Contaminated Soils Excavation and On-Site Thermal Treatment/Recreational Facilities Replacement

This alternative would provide the highest level of protection to human health and the environment. Under this alternative, contaminated soils above clean-up goals would be excavated and treated on site. This alternative meets the regulatory preference to utilize treatment-based remedies. It is expected that ARARs would not be met for a period of up to 20 years. Long-term effectiveness and permanence and the reduction of toxicity, mobility or volume are rated high for this alternative. However, there may be administrative delays in the implementation of this alternative related to the technical scrutiny of this alternative.

VOCs released during excavation can be effectively controlled such that there are no adverse impacts to public health. The costs to implement this alternative are less than the bioremediation alternative. Further, this alternative will be completed in less time and at a higher overall protection to human health due to an increase of materials handling associated with the bioremediation alternative.

8.2.5 Alternative SCS-7E: Soil Vapor Extraction/Air Sparging/Monitoring/Groundwater Use Restrictions/Catalytic Oxidation

This alternative includes soil vapor extraction technology, which would comply with soil ARARs given that contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated in a reasonable timeframe.

This alternative also includes implementing an air sparging system at the source. The air sparging system can be operated reliably over long periods of time and it can reduce leachate contaminant concentrations in the areas where it operates. Therefore, the air sparging system offers moderate long-term effectiveness in meeting the remedial action objectives for groundwater.

This alternative would provide protection to human health and the environment by reducing the mass of contaminants available to leach from soils. This alternative also would reduce the mobility, toxicity and volume of the saturated soil and leachate-borne contaminants. It is expected that ARARs would not be met for a period of up to 25 years. This alternative is relatively straightforward to implement and is less costly than the excavation and on-site thermal treatment alternative (SCS-7D). Overall, this alternative would result in moderate disturbance to the community and the surrounding area.

8.3 Source Control Soil Area 9/10

The relative performance of each of the source control remedial alternatives for Area 9/10 is summarized in **Table 8-3.** Each of these alternatives is discussed in greater detail in the following subsections. Limited data exists for this source area. Additional sampling would be necessary to verify the conclusions drawn in this FFS. The intended future land use for this source area was assumed to be residential.

8.3.1 Alternative SCS-9/10A: No Action

No actions would be taken for this alternative. This alternative would provide no additional protection to human health or the environment. Contaminants in the soils would continue to migrate away from the source area with contaminant concentrations reduced to acceptable levels only through natural attenuation mechanisms.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a significant period of time. Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with no associated costs to implement.

8.3.2 Alternative SCS-9/10B: Limited Action - Deed Restrictions

This alternative would provide a limited level of protection to human health and the environment from contaminated soils. Contaminants in the soils would continue to migrate away from the source area until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms. However, restrictions placed on land use would minimize future uses of the area that could lead to exposure to contaminants.

Based on limited data, it is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a significant period of time. Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with minimal costs to implement.

8.3.3 Alternative SCS-9/10C: Soil Vapor Extraction

This alternative would provide a better degree of protection to human health and the environment by reducing the mass of contaminants available to leach from soils to eventually site-wide groundwater. Overall, the soil vapor extraction technology is easily implementable, and would result in minimal disturbance to the community and the surrounding area.

TABLE 8-3
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL SOIL ALTERNATIVES FOR SOURCE AREA 9/10

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCS-9/10A: No Action	**No** Not protective of human health or the environment, except through natural attenuation.	**No** ARARs not attained.	**Low** No level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** No remedial actions take place under this alternative.	**$0**
SCS-9/10B: Limited Action-Deed Restrictions	**No** Somewhat protective of human health. Not protective of the environment. Requires maintenance to be effective.	**No** ARARs not attained.	**Low** Minimal level of long term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** Administratively easy to implement if property owners comply.	**$28,000**
SCS-9/10C: Soil Vapor Extraction	**Yes** Protective of human health and the environment. Reduces the mass of contaminants.	**Yes** Complies with soil ARARs within a reasonable time frame.	**Medium** Does mitigate further contaminant releases to leachate. SVE is a reliable and well-demonstrated technology for the removal of VOCs.	**Medium** Significant reduction of toxicity, mobility and volume could be realized.	**Medium** Minimal risks to on site workers. The time frame in which protection of human health and the environment would be attained is reasonable.	**Medium** Technically feasible but there are space considerations.	**$4,308,000**

This alternative would comply with soil ARARs given that contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated. Additional data are necessary to fully evaluate the need for leachate control. Costs to implement this alternative are the highest for the source control alternatives for this source area.

8.4 Source Control Soil Area 11

The relative performance of each of the source control remedial alternatives for Area 11 is summarized in **Table 8-4**. The intended future land use for this source area was assumed to be residential. Each of these alternatives is discussed in greater detail in the following subsections.

8.4.1 Alternative SCS-11A: No Action

No actions would be taken for this alternative. This alternative would provide no additional protection to human health or the environment. Contaminants in the soils would continue to migrate away from the source area with contaminant concentrations reduced to acceptable levels only through natural attenuation mechanisms.

It is expected that contamination would migrate under implementation of this alternative and soil ARARs would not be met for a significant period of time.

However, the results of the fate and transport analysis indicated that leachate ARARs would be attained at the GMZ boundary under the No Action scenario. Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with no associated costs to implement.

8.4.2 Alternative SCS-11B: Limited Action - Deed Restrictions

This alternative would provide a limited level of protection to human health and the environment from contaminated soils. Contaminants in the soils would continue to migrate away from the source area until contaminant concentrations are reduced to acceptable levels through natural attenuation mechanisms. However, restrictions placed on land use would minimize future uses of the area that could lead to exposure to contaminants.

It is expected that contamination would migrate under implementation of this alternative and soil ARARs would not be met for a significant period of time. As for the No Action alternative, leachate currently meets ARARs at the GMZ boundary. Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural

TABLE 8-4
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL SOIL ALTERNATIVES FOR SOURCE AREA 11

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCS-11A: No Action	No Not protective of human health or the environment, except through natural attenuation.	No Soil ARARs not attained.	Low No level of long-term effectiveness or permanence.	Low/Medium No reduction except through natural attenuation.	Low No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	High No remedial actions take place under this alternative.	$0
SCS-11B: Limited Action-Deed Restrictions	No Somewhat protective of human health. Not protective of the environment.	No Soil ARARs not attained.	Low Minimal level of long-term effectiveness or permanence.	Low/Medium No reduction except through natural attenuation.	Low No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	High Administratively easy to implement if property owners comply.	$28,000
SCS-11C: Soil Vapor Extraction/ Catalytic Oxidati	Yes Protective of human health and the environment. Reduces the mass of contaminants.	Yes Complies with soil ARARs within a reasonable time frame.	Medium Does mitigate further contaminant releases to groundwater. SVE is a well-demonstrated technology for the removal of VOCs.	Medium/High Significant reduction of toxicity, mobility and volume could be realized, however, residual NAPL could provide a continuing source of contaminants.	Medium/High Minimal risks to on-site workers. Protection of human health and the environment can be achieved in an acceptable timeframe.	Medium/High Technically feasible but there are space considerations.	$3,185,500

attenuation mechanisms. This alternative would be easily implementable, with minimal costs to implement.

8.4.3 Alternative SCS-11C: Soil Vapor Extraction/Catalytic Oxidation

This alternative would provide a better degree of protection to human health and the environment by reducing the mass of contaminants available to leach from soils to eventually site-wide groundwater. Overall, the soil vapor extraction technology is easily implementable, and would result in minimal disturbance to the community and the surrounding area.

This alternative would comply with ARARs given that contaminant concentrations would be reduced and the continued migration of contaminants to leachate would be mitigated. The results of the fate and transport analysis indicate that although residual NAPL could provide a continuing source of contaminants to leachate, control of this medium is not necessary. ARARs for leachate would be met at the GMZ boundary. Costs to implement this alternative are the highest for the source control alternatives for this source area.

8.5 Source Control Leachate Area 4

The relative performance of each of the source control leachate remedial alternatives for Area 4 is summarized in **Table 8-5**. Each of these alternatives is discussed in greater detail in the following subsections.

8.5.1 Alternative SCL-4A: No Action/Leachate Monitoring/ Restrictions on Groundwater Usage/Natural Attenuation

This alternative includes implementing institutional controls and a groundwater and leachate monitoring program. This alternative would provide no additional protection to downgradient receptors or the environment. Contaminants would continue to migrate away from the source area into site-wide groundwater with contaminant concentrations reduced to acceptable levels only through natural attenuation mechanisms.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for at least 70 years. Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with minimal costs to implement the monitoring program.

TABLE 8-5
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL LEACHATE ALTERNATIVES FOR SOURCE AREA 4

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCL-4A: No Action / Leachate Monitoring / Groundwater Use Restrictions/ Natural Attenuation	No Protective of human health but not the environment.	No ARARs not attained.	Low No level of long-term effectiveness or permanence.	Low No reduction except through natural attenuation.	Low No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	High Easily implementable	$269,000
SCL-4B: Limited Action with Pump and Treat/ Leachate Monitoring/ Groundwater Use Restrictions	Yes Not fully protective of human health and the environment. Reduces the mass of contaminants.	Yes Complies with ARARs within a reasonable time frame.	Medium Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Residual NAPL could provide a continuing source of contaminants.	Medium Limits the mobility of the leachate-borne contaminants. A modest reduction in toxicity and volume could be realized	Low/Medium Limited exposure during construction. The timeframe for protection of human health and the environment is somewhat long.	High Technically easy to implement.	$732,000
SCL-4C: Air Sparging at GMZ Boundary/ Leachate Monitoring/ Groundwater Use Restrictions	Yes Not fully protective of human health and the environment downgradient of the GMZ. Reduces the mass of contaminants.	Yes Complies with ARARs within a reasonable time frame.	Medium Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Residual NAPL could provide a continuing source of contaminants. Reliable over long term. Effectively reduces contaminant concentrations in the areas where it operates.	Medium/High Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume.	Medium/High Limited exposure during construction.	Medium Relatively straightforward to implement.	$2,522,000
SCL-4D: Reactive Barrier Wall/ Monitoring/ Groundwater Use Restrictions	Yes Protective of human health and the environment downgradient of the GMZ. Reduces the mass of contaminants.	Yes Complies with ARARs.	Medium Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Effectively reduces contaminant concentrations in the areas where it operates.	High Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume.	Medium Limited exposure during construction but physical dangers near homes. The shortest time period to achieve protection of human health and the environment.	Low to Medium Relatively difficult to implement. Excavation of trench and dewatering complicate construction.	$5,911,000
SCL-4E: Air Sparging at Source and GMZ Boundary/ Leachate Monitoring/ Groundwater Use Restrictions	Yes Not fully protective of human health and the environment. Reduces the mass of contaminants.	Yes Complies with ARARs within a reasonable time frame.	Medium/High Complete long-term effectiveness in meeting RAOs. Reliable over long term. Effectively reduces contaminant concentrations in the areas where it operates.	Medium/High Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume.	Medium/High Limited exposure during construction. Short time period to achieve protection of human health and the environment.	Medium Relatively straightforward to implement	$2,796,000

8.5.2 Alternative SCL-4B: Limited Action/Leachate Monitoring/ Leachate Collection and Treatment by Air Stripping Unit/ Off-site Surface Water Discharge/Groundwater Use Restrictions

This alternative would provide a limited level of protection to downgradient receptors and the environment. This alternative includes a hydraulic containment scenario that includes treatment of the collected water and discharge on site into neighboring surface waters. This alternative also includes implementing institutional controls within the GMZ boundary and a groundwater monitoring program to evaluate the effectiveness of the containment system.

This alternative would not comply with ARARs at the boundary of the GMZ (for 35 to 45 years) given that contaminant concentrations above MCLs would continue in the site-wide groundwater. There would be minimal reduction in toxicity, mobility, or volume of contaminants. This alternative would be easily implementable, with minimal costs to implement.

8.5.3 Alternative SCL-4C: Air Sparging along the GMZ Boundary/Leachate Monitoring/Groundwater Use Restrictions

This alternative would provide a better degree of protection to human health and the environment. This alternative includes constructing an air sparge system at the boundary of the GMZ. The gas and stripped solvents would be collected using vapor extraction wells. Note that institutional controls are also a component of this alternative.

This alternative would not comply with ARARs at the boundary of the GMZ for at least 15 to 25 years. This alternative will result in better treatment efficiencies and treatment times than hydraulic containment with air stripping. However, the costs to implement this alternative are higher than the hydraulic containment scenario.

8.5.4 Alternative SCL-4D: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

This alternative includes construction of a funnel and gate reactive barrier system at the downgradient boundary of the GMZ. This alternative shows similar levels of protection when compared to alternative SCL-4C. However, it is expected that the reactive barrier system will be more effective in limiting the mobility of the leachate-borne contaminants. This alternative has become more widely used in similar applications. However, as with construction of any trench, underground obstructions and dewatering complicate implementation of this alternative.

As presented in the fate and transport discussion (see Section 5), the reactive barrier system would achieve ARARs in a relatively short time (less than one year) compared to the other remedial alternatives. The costs to implement this alternative are the highest for source control leachate alternatives for source Area 4.

8.5.5 Alternative SCL-4E: Air Sparging along the GMZ Boundary and Source Area/Leachate Monitoring/Groundwater Use Restrictions

This alternative includes implementing an air sparge well point system at the source and at the boundary of the GMZ. Implementing this alternative effectuates treatment of the contaminant mass within the saturated soils and the leachate, such that eventually the leachate within the GMZ will reach MCLs. The air sparge system can be operated reliably over long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates. Therefore, the air sparge system offers complete long-term effectiveness in meeting the remedial action objectives.

This alternative effectively limits the mobility of the leachate-borne contaminants and effectively reduces contaminant toxicity and volume. This alternative would not comply with ARARs at the boundary of the GMZ for 10 to 20 years. This alternative is relatively straightforward to implement and is less costly than the reactive barrier system.

8.6 Source Control Leachate Area 7

The relative performance of each of the source control leachate remedial alternatives for Area 7 is summarized in **Table 8-6**. Each of these alternatives is discussed in greater detail in the following subsections.

8.6.1 Alternative SCL-7A: No Action/Leachate Monitoring/ Groundwater Use Restrictions/Natural Attenuation

This alternative includes implementing institutional controls and a groundwater and leachate monitoring program. This alternative would provide no additional protection to downgradient receptors or the environment. Contaminants would continue to migrate away from the source area into site-wide groundwater with contaminant concentrations reduced to acceptable levels only through natural attenuation mechanisms.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a period of 80 to 90 years. Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with minimal costs to implement the monitoring program.

TABLE 8-6
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL LEACHATE ALTERNATIVES FOR SOURCE AREA 7

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARARs	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCL-7A: No Action/ Leachate Monitoring/ Groundwater Use Restrictions	**No** Protective of human health. Not protective of the environment.	**No** ARARs not attained.	**Low** No level of long-term effectiveness or permanence.	**Low** No reduction except through natural attenuation.	**Low** No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	**High** Easily implementable	**$347,000**
SCL-7B: Multi-Phase Extraction/Leachate Containment and Treatment/ Groundwater Use Restrictions	**Yes** Protective of human health and the environment. Reduces the mass of contaminants.	**Yes** Complies with ARARs within a reasonable time frame.	**Medium/High** Does mitigate further contaminant migration from the GMZ to site-wide groundwater. NAPL source would be addressed.	**High** Limits the mobility of the saturate soils and leachate-borne contaminants. A significant reduction of toxicity and volume could be realized. Accelerated mass removal from both saturated soils and leachate.	**Low/Medium** Limited exposure during construction. The timeframe for protection of human health and the environment is moderate.	**High** Technically easy to implement.	**$2,637,000**
SCL-7C: Reactive Barrier Wall/ Leachate Monitoring/ Groundwater Use Restrictions	**Yes** Protective of human health and the environment downgradient of the GMZ. Reduces the mass of contaminants.	**Yes** Complies with ARARs.	**Medium** Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Effectively reduces contaminant concentrations in the areas where it operates.	**High** Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume.	**Medium** Limited exposure during construction. The shortest timeframe for protection of human health and the environment.	**Medium** Relatively straightforward to implement. Excavation of trench and dewatering complicate construction.	**$4,391,000**

8.6.2 Alternative SCL-7B: Multi-Phase Extraction/Collect Leachate and Treat by Air Stripping Unit/Discharge to On-site Surface Water/Groundwater Use Restrictions/Monitoring

This alternative would be protective of downgradient receptors and the environment. This alternative includes a hydraulic containment scenario that includes treatment of the collected water and discharge on site into neighboring surface waters. In addition, multi-phase extraction (MPE) would be used in the areas with the highest contaminant concentrations to accelerate mass removal from both saturated soils and leachate. This alternative also includes implementing institutional controls within the GMZ boundary and a groundwater monitoring program to evaluate the effectiveness of the containment system.

This alternative would not comply with ARARs at the boundary of the GMZ (for a period of approximately 40 years) given that contaminant concentrations above MCLs would continue in the site-wide groundwater. There would be a significant reduction in toxicity, mobility, or volume of contaminants via operation of the MPE system. This alternative would be easily implementable, with moderate costs to implement.

8.6.3 Alternative SCL-7C: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

This alternative includes construction of a funnel and gate reactive barrier system at the downgradient boundary of the GMZ. The reactive barrier system is protective of downgradient human health and the environment. This alternative is effective in limiting the mobility of the leachate-borne contaminants. This alternative has become more widely used in similar applications. However, as with construction of any trench, underground obstructions and dewatering complicate implementation of this alternative.

As presented in the fate and transport discussion (see Section 5), the reactive barrier system would achieve ARARs in a relatively short time (less than one year) whereas the other alternatives will not attain ARARs. The costs to implement this alternative are the highest for source control leachate alternatives for source Area 7.

8.7 Source Control Leachate Area 9/10

The relative performance of each of the source control leachate remedial alternatives for Area 9/10 is summarized in **Table 8-7**. Each of these alternatives is discussed in greater detail in the following subsections. It is noted that the length of time to achieve ARARs could not accurately be predicted given the existence of data gaps in the source area.

TABLE 8-7
SOUTHEAST ROCKFORD SOURCE CONTROL OPERABLE UNIT
ROCKFORD, ILLINOIS

FOCUSED FEASIBILITY STUDY
COMPARISON OF REMEDIAL ALTERNATIVES
SOURCE CONTROL LEACHATE ALTERNATIVES FOR SOURCE AREA 9/10

Alternative	Overall Protection of Human Health and the Environment	Compliance with ARAR	Long-term Effectiveness and Permanence	Reduction of Toxicity, Mobility, or Volume	Short-term Effectiveness	Implementability	Cost
SCL-9/10A: No Action/ Leachate Monitoring/ Groundwater Use Restrictions/ Natural Attenuation	No Protective of human health. Not protective of the environment.	No ARARs not attained.	Low No level of long-term effectiveness or permanence.	Low No reduction except through natural attenuation.	Low No risks through implementation. Protection of human health and the environment would not occur in a reasonable timeframe.	High Easily implementable	$217,000
SCL-9/10B: Limited Action with Pump and Treat/ Groundwater Use Restrictions	Yes Not fully protective of human health and the environment. Reduces the mass of contaminants.	Yes Complies with ARARs within a reasonable time frame.	Medium Does mitigate further contaminant migration from the GMZ to site-wide groundwater.	Medium Limits the mobility of the leachate-borne contaminants. A modest reduction in toxicity and volume could be expected.	Low/Medium Limited exposure during construction. The timeframe for protection of human health and the environment is somewhat long.	Medium Technically feasible to implement. Treated groundwater will have long distance to travel to storm sewer.	$2,440,000
SCL-9/10C: Air Sparging at GMZ Boundary/ Monitoring/ Groundwater Use Restrictions	Yes Not fully protective of human health and the environment downgradient of the GMZ. Reduces the mass of contaminants.	Yes Complies with ARARs within a reasonable time frame.	Medium Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Reliable over long term. Effectively reduces contaminant concentrations in the areas where it operates.	Medium/High Limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume.	Medium/High Limited exposure during construction.	Medium Relatively straightforward to implement. Construction considerations involved in placing piping under 9th street.	$3,200,000
SCL-9/10D: Reactive Barrier Wall/ Groundwater Use Restrictions	Yes Protective of human health and the environment downgradient of the GMZ. Reduces the mass of contaminants.	Yes Complies with ARARs.	Medium Does mitigate further contaminant migration from the GMZ to site-wide groundwater. Effectively reduces contaminant concentrations in the areas where it operates.	High Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume.	Low/Medium Limited exposure during construction. Would achieve protection of human health and the environment in the shortest timeframe.	Low to Medium Relatively difficult to implement. Excavation of trench and dewatering complicate construction.	$3,523,000
SCL-9/10E: Air Sparging at Source and GMZ Boundary	Yes Not fully protective of human health and the environment. Reduces the mass of contaminants.	Yes Complies with ARARs within a reasonable time frame.	Medium/High Complete long-term effectiveness in meeting RAOs. Effectively reduces contaminant concentrations in the areas where it operates. Reliable over long term.	Medium/High Effectively limits the mobility of the leachate-borne contaminants. Effectively reduces contaminant toxicity and volume.	Medium/High Limited exposure during construction and a short period to achieve protection of human health and the environment.	Medium Relatively straightforward to implement. Construction considerations involved in placing piping under 9th street and Plant No. 1and former Plant No. 2 foundations.	$3,619,000

8.7.1 Alternative SCL-9/10A: No Action/Leachate Monitoring/ Groundwater Use Restrictions/Natural Attenuation

This alternative includes implementing institutional controls and a groundwater and leachate monitoring program. This alternative would provide no additional protection to downgradient receptors or the environment. Contaminants would continue to migrate away from the source area into site-wide groundwater with contaminant concentrations reduced to acceptable levels only through natural attenuation mechanisms.

It is expected that contamination would migrate under implementation of this alternative and ARARs would not be met for a significant period of time. Since there are no treatment options involved with this alternative, there would be no reductions in toxicity, mobility, or volume of contaminants, except through natural attenuation mechanisms. This alternative would be easily implementable, with minimal costs to implement the monitoring program.

8.7.2 Alternative SCL-9/10B: Limited Action/Leachate Collection and Treatment by Air Stripping Unit/Discharge Treated Leachate at Off-site Surface Water/Groundwater Use Restrictions

This alternative would provide a limited level of protection to downgradient receptors and the environment. This alternative includes a hydraulic containment scenario that includes treatment of the collected water and discharge off site into neighboring surface waters. This alternative also includes implementing institutional controls within the GMZ boundary and a groundwater monitoring program to evaluate the effectiveness of the containment system.

This alternative would comply with ARARs at the boundary of the GMZ. There would be minimal reduction in toxicity, mobility, or volume of contaminants. This alternative would be easily implementable, with minimal costs to implement.

8.7.3 Alternative SCL-9C: Air Sparging along the GMZ Boundary/Monitoring/Groundwater Use Restrictions

This alternative would provide a better degree of protection to human health and the environment. This alternative includes constructing an air sparge system at the boundary of the GMZ. The gas and stripped solvents would be collected using vapor extraction wells. Note that institutional controls are also a component of this alternative.

This alternative would eventually comply with ARARs at the boundary of the GMZ given that contaminant concentrations above MCLs would be treated as the leachate passes through the well point system. This alternative will result in better treatment efficiencies and treatment times than hydraulic containment with air stripping.

However, the costs to implement this alternative are higher than the hydraulic containment scenario.

8.7.4 Alternative SCL-9/10D: Reactive Barrier Wall/Leachate Monitoring/Groundwater Use Restrictions

This alternative includes construction of a funnel and gate reactive barrier system at the downgradient boundary of the GMZ. This alternative shows similar levels of protection when compared to alternative SCL-9/10C. However, it is expected that the reactive barrier system will be more effective in limiting the mobility of the leachate-borne contaminants. This alternative has become more widely used in similar applications. However, as with construction of any trench, underground obstructions and dewatering complicate implementation of this alternative.

The reactive barrier system would achieve ARARs in a relatively short time compared to the other remedial alternatives. The costs to implement this alternative are the highest for source control leachate alternatives for source Area 9/10.

8.7.5 Alternative SCL-9/10E: Air Sparging along the GMZ Boundary and Source Area/Monitoring/Groundwater Use Restrictions

This alternative includes implementing an air sparge well point system at the source and at the boundary of the GMZ. Implementing this alternative effectuates treatment of the contaminant mass within the saturated soils and the leachate, such that eventually the leachate within the GMZ will reach MCLs. The air sparge system can be operated reliably over long periods of time and it can effectively reduce leachate contaminant concentrations in the areas where it operates. Therefore, the air sparge system offers complete long-term effectiveness in meeting the remedial action objectives.

This alternative effectively limits the mobility of the leachate-borne contaminants and effectively reduces contaminant toxicity and volume. This alternative is relatively straightforward to implement and is less costly than the reactive barrier system.

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